Engineering Library

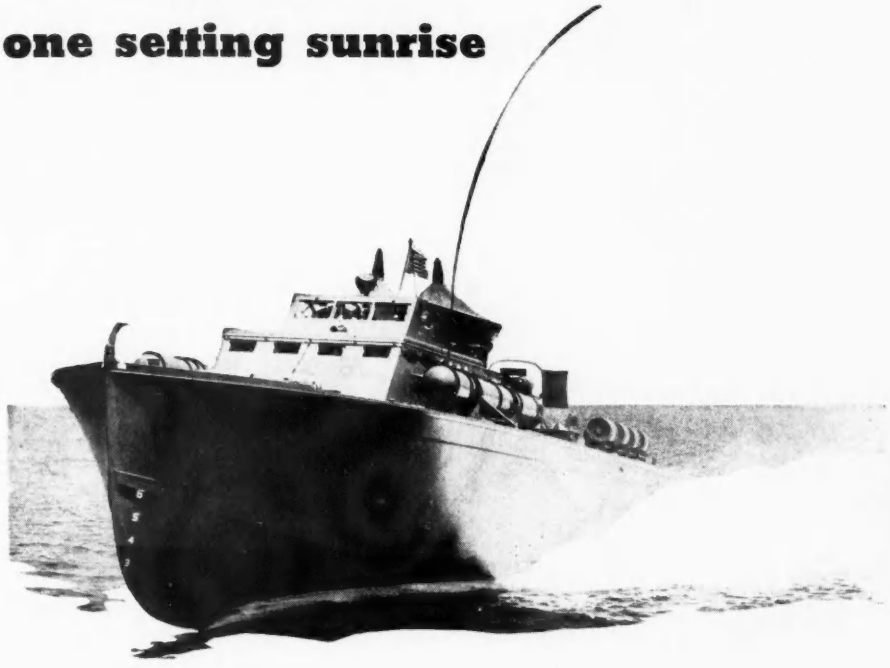
JUL 13 1943

AUTOMOTIVE and Aviation INDUSTRIES

JULY 1, 1943

Coming up!

one setting sunrise

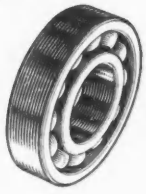


☆ Many's the Jap warship whose Rising Sun was set, *for keeps* by the sting of our famed P-T boats . . . in which anti-friction bearings overcome friction and prevent wear.

Supplying ball bearings by the millions—for P-T boats and for tanks, planes, trucks, jeeps *and the machines which make them* . . . imposes a heavy obligation which the New Department organization accepts as a privilege with Victory the goal!

3173-A

NEW DEPARTURE division of GENERAL MOTORS



New Departure

THE FORGED STEEL BEARING

LUBRICATION ENGINEERING • • • LUBRICATION ENGINEERING • • • LUBRICATION ENGINEERING • • • LUBRICATION E

Cutting oil *News* letter

Practical suggestions from the field on how cutting oils and coolants are being used by midwest machine operators to lick tough wartime jobs.

JULY, 1943

How longer tool life was obtained in making 250 lb. "practice" bombs

Operations by a stamping company on 250 lb. "practice type" bombs included drilling, reaming, tapping of the nose, cutting off tail end, and chasing an internal thread. Several oils failed to do the job right. Then the operator switched to Stanicool H. D. Soluble Oil (6 to 1 mixture); said it not only produced a better finish, but gave much longer tool life.

Bothered by Buildup on Dies? This was a real problem to a northwest manufacturer . . . on the male die on a deep draw job (6 in. deep) using 26 gauge steel sheets. Two parts Stanostamp "C" to one part water applied by swab ended this problem; also gave longer tool life at reduced cost.

Released 8 Men for Other Plant Work.

In producing 90 mm. anti-aircraft shells, a wrench manufacturer bumped into two headaches: (1) Use of high grade cutting oil at high surface speed and depth of cut caused excessive smoke, made parts too hot to handle. (2) Discoloration of the copper bands kept eight men busy buffing them. Working with plant operators, a Standard Lubrication Engineer selected a special soluble oil for this job. Last report was: perfect work coming through . . . no more rejects . . . the 8 men released for other work in the plant . . . ordnance inspectors enthusiastic.

Didn't ask for extra tool life but got it . . . as a bonus! The main idea in this plant was to lick the twin problems of 10% rejects and breaking along the edges when stamping radiator fins. Variation in hardness of material was the root of the trouble . . . which completely disappeared after changing over to Acme Base Oil Extra Heavy mixed 1 to 6 with paraffine oil. And to top it all off, a 40% increase in tool life has been secured.

How to Prevent Staining on Aluminum After Machining. Here's a practical suggestion that will interest many operators handling aluminum parts. In order to get away from staining and deposits on aluminum after machining, a battery and parts maker tried out a number of cutting oils. Final report is that Stanicut 62 FC was the only one to give full satisfaction. It is now standard for this operation.

OIL IS AMMUNITION . . . USE IT WISELY

World's Largest Planer Takes 6 Cuts At Once. A rolling mill and foundry company recently installed what was said to be the largest planer in the world. It has a table weighing 75 tons, carries a load of 300,000 lbs., takes six cuts at one time. Six barrels of Stanolex No. 31 were placed in the system for dependable lubrication.

Army Inspectors Give Entire Approval. A farm machinery manufacturer, in recently converting to war production, found it difficult to secure approval of finish and cleanliness of parts for plating after machining and tapping SAE 4150 steel. They started using Premier Cutting Oil No. 110 about 5 months ago, and army inspectors have given entire approval on workmanship ever since. More ease in cleaning parts for plating with this oil was a plus advantage.

When You Bump Up Against Special Cutting Oil Problems

• If you are running into trouble in handling war work, and find it tough to get the necessary accuracy, finish, and tool life on converted machines . . . or if you have other perplexing machining jobs that a more efficient application of cutting oils may help answer . . . call in a Standard cutting oil specialist. Phone or write Standard Oil Company (Indiana) office, or 910 S. Michigan Ave., Chicago, Ill., for the Engineer nearest you. In Nebraska, contact any Standard Oil Company of Nebraska office.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

AUTOMOTIVE and Aviation INDUSTRIES

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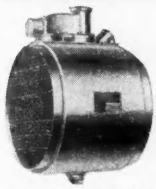
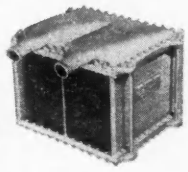
YOUNG Oil Temperature Regulators for "air-cooled" engines and YOUNG radiators for liquid cooled engines are standard equipment on Allied combat and training planes . . . a tribute to YOUNG engineering and manufacturing skill.



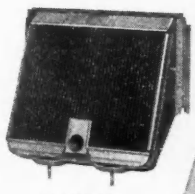
OIL TEMPERATURE REGULATOR



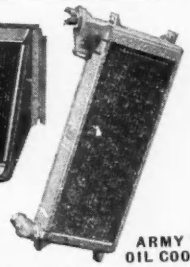
LIQUID COOLANT RADIATOR

Army

YOUNG Heat Transfer Equipment for Tanks, Half-tracks and Mobile Units is proving its worth under the stress and strain of active combat duty. Tank Oil Coolers are built with a patented tube and fin construction. Special slanted core, heavy-duty Scout Car Radiators are built to Army specifications.



SLANTED CORE SCOUT CAR RADIATOR

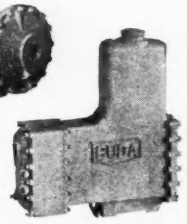


ARMY TANK OIL COOLANT

Marine

YOUNG engineers are specialists in designing and building Heat Transfer Equipment for marine installations. The Combination Oil Cooler, Heat Exchanger and Surge Tank illustrated is vital to shipboard fire fighting equipment. YOUNG Tube Bundle and Shell Heat Exchangers are available in all sizes and incorporate tested and tried construction features.

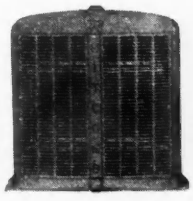
TUBE BUNDLE AND SHELL HEAT EXCHANGER



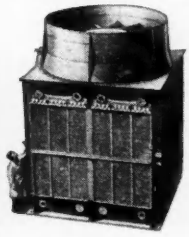
COMBINATION OIL COOLER, HEAT EXCHANGER AND SURGE TANK

Diesel

Whether it is a heavy-duty radiator for a Diesel locomotive, or a new Quad (radiator-type) Cooling Tower, YOUNG Diesel cooling equipment has demonstrated its superiority and efficiency. YOUNG engineered Diesel cooling units are products of modern research and testing laboratories, a staff of engine specialists and complete manufacturing facilities.



HEAVY DUTY DIESEL RADIATORS



"QUAD" ATMOSPHERIC COOLING TOWER

YOUNG RADIATOR COMPANY
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Buy Bonds, Produce More, Salvage Scrap, Win the War

Young

Product of Young Engineering and Manufacturing SERVICE Specializing in Heat Transfer Products

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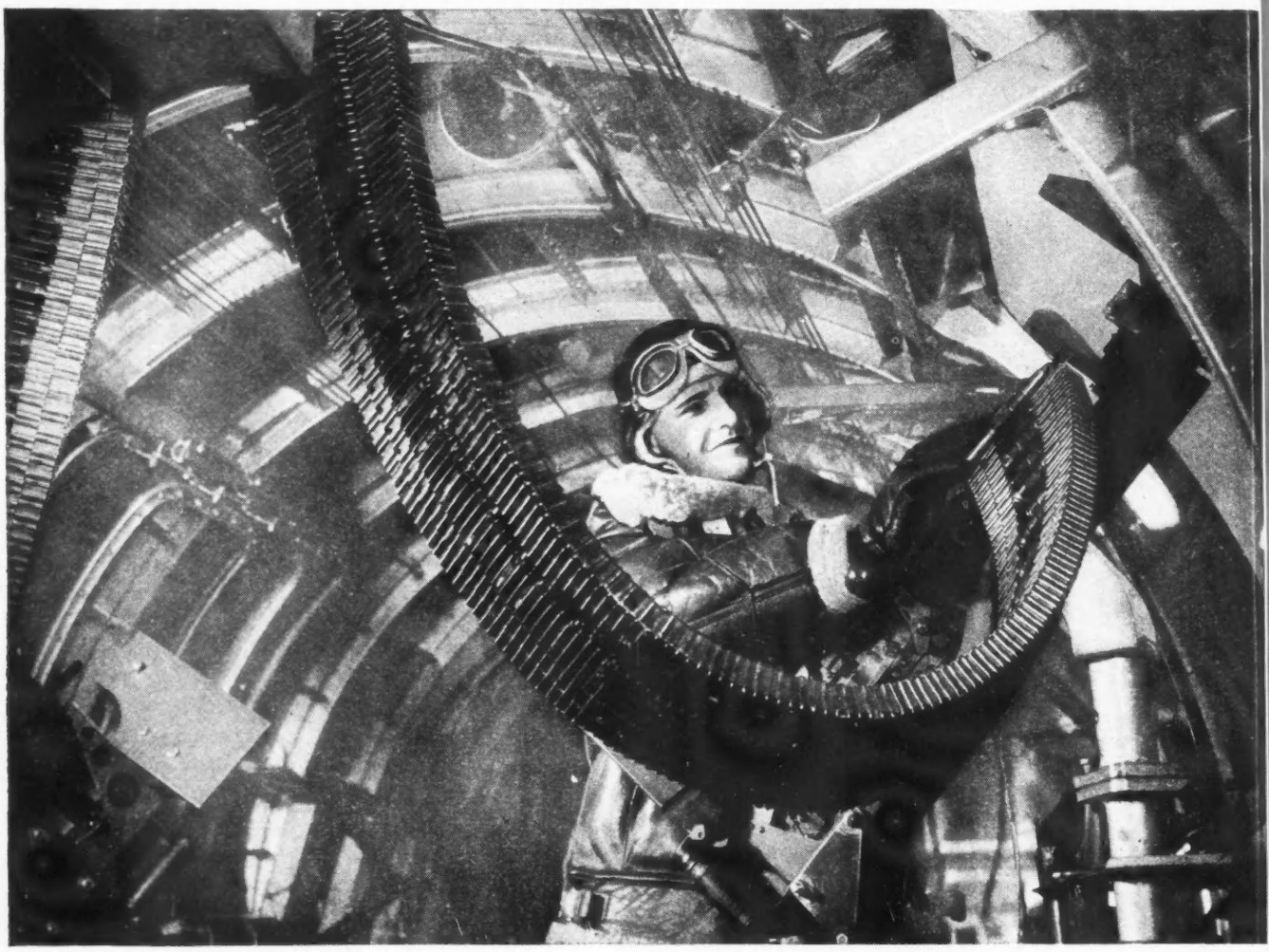

600 ROUNDS-A-MINUTE...per Gun!

INSIDE this Flying Fortress, the side gunner inspects belts which feed up to 600 bullets a minute as the big ship gets set for a trip over enemy targets. For guns like these, the need is absolutely vital for unlimited amounts of ammunition.

In producing not only the ammunition, but guns, planes, ships, tanks, and other weapons, war plants everywhere are increasing output and lengthening cutting-tool life, by using *Texaco Cutting Oils.*

For example, on both *al*uminum and *mag*nesium, *Texaco ALMAG Cutting Oil* adequately cools and lubricates the cutting tools, prolongs their life, increases cutting speeds, steps up output. *ALMAG* is transparent, permitting the operator to *see* . . . and is non-irritating to the skin.

So effective have Texaco lubricants proved that they are definitely preferred in many other important fields, a few of which are listed in the panel.

A Texaco Engineer specializing in cutting coolants will gladly cooperate in the selection of the most suitable lubricants for your equipment. Just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

THEY PREFER TEXACO

★ More buses, more bus lines and more bus-miles are lubricated and fueled with Texaco than with any other brand.

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TEXACO CUTTING, SOLUBLE AND HYDRAULIC OILS FOR FASTER MACHINING

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT – CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

IN THIS ISSUE . . .

AUTOMOTIVE and AVIATION INDUSTRIES

Volume 89 July 1, 1943 Number 1

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Truck Reserve Shrinks

Shrinkage in the Nation's reserve pool of new commercial motor vehicles is evidenced by a report published by the Automotive Division of the War Production Board.

The report shows that a total of 65,828 trucks remained in the pool on June 1, 1943. The figure includes those vehicles held in the pool for Army, Navy, Maritime Commission and other specified agencies as well as the number held for essential civilian rationing; and is made up of 19,975 light trucks, 41,774 medium trucks, and 4079 heavy trucks. It reveals a withdrawal from the pool of 16,500 trucks of all types since March 6, 1943, when the total was 82,328.

In addition to the trucks the report shows that the pool still holds 3045 trailers and 987 third axle attachments.

Make Every Pay Day

"BOND DAY"

Get back of the Pay-Roll Savings Plan by encouraging employees to turn part of their earnings *regularly* into tanks and planes and guns through systematic purchase of

U. S. WAR BONDS

Tailoring American Planes to the Job 17

When an airplane rolls off the production line at any of the factories it is not known where it will be sent into service. It is first delivered to a Modification Center where it is specially equipped for the conditions and climate in which it is to serve. Many of these stations are in operation now and go far towards making American planes "tops" in service for the particular environment in which they operate. It is a most interesting account. Read it.

Gear Sets for Medium Tanks on the Production Line 22

What was one of the most modern of the passenger car rear axle plants before Pearl Harbor is now one of the finest of medium tank transmission producers. Liberally illustrated.

Production Illustration as Applied to Precision Parts 28

This is the description of a technique that is becoming more and more used. Its accomplishments are so wide that each new account of its operation brings out new adaptations. Keep abreast of the developments in a growing system.

Impression-Cast Jaws for Aircraft Fittings 34

American Screw Products have stepped right out into the front row in production for war. After a season of experimentation they have developed a system for the manufacture of airplane fittings that is outstanding. It is authoritatively described and adequately illustrated.

SAE Meetings in Cleveland and Detroit 40

The SAE has recently held two important meetings at which many subjects of interest to engineers were discussed. Much of the meat of these discussions will be found in this account of the meetings. Read it from start to finish. The most interest for you may be anywhere in the article.

COMPLETE ANALYSIS

OF PRODUCTION REQUIREMENTS

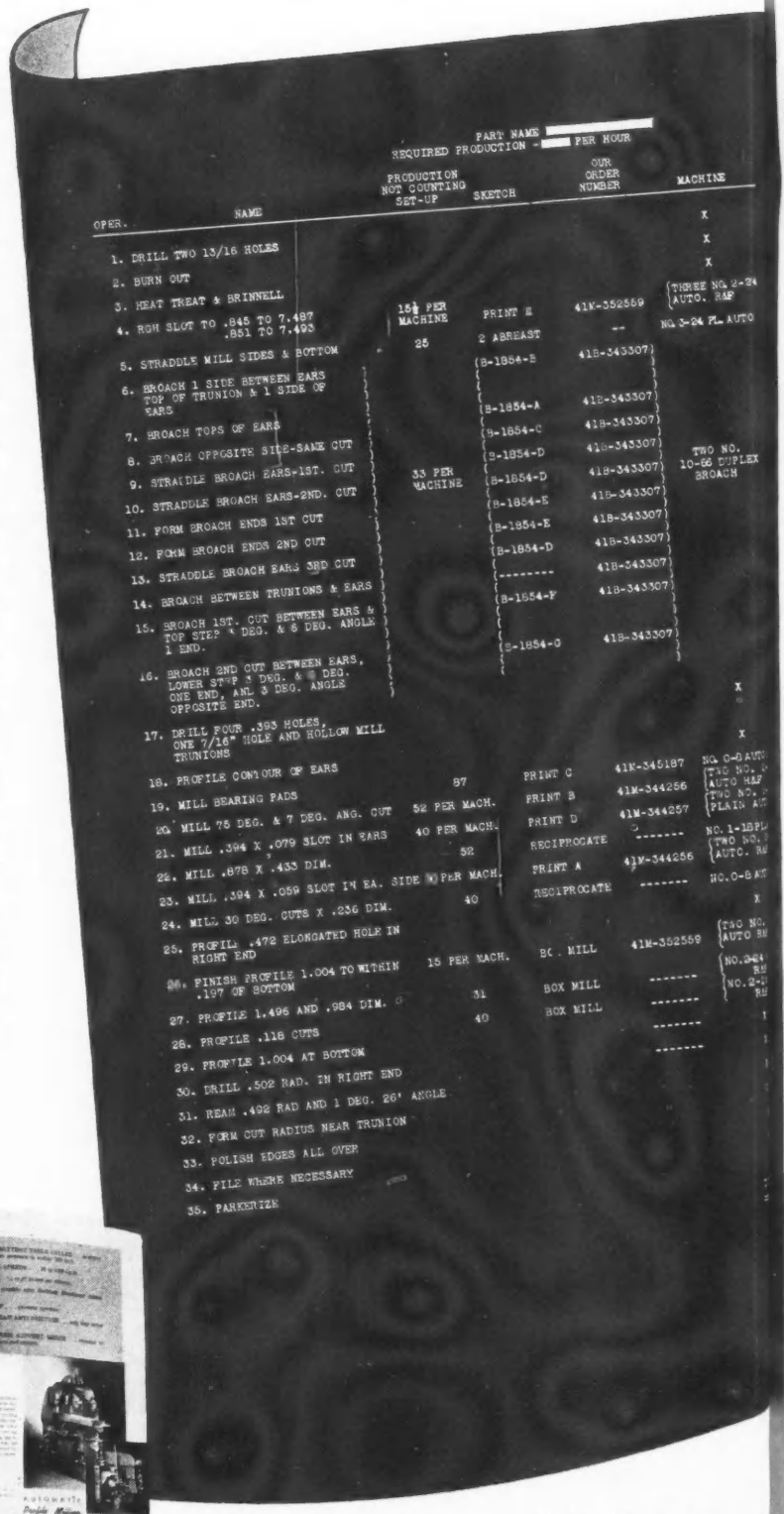
By CINCINNATI Service Engineers

Saves Time . . . Eliminates Long "Build Up" to High Production Rate

● In this highly mechanized conflict, designs of war materiel change even more rapidly than the ever-changing pattern of peace-time goods. The armies who have the most practical designs obviously have the greatest advantage. Nevertheless, the advantage remains on paper until the material is *delivered* to our armed forces. They need it *quickly* to win quickly.

This is where CINCINNATI Service Engineers can help you. They have years of experience in working out methods of producing parts requiring machining operations in the fields of milling, grinding, broaching, lapping and cutter sharpening. The most modern data, substantiated by a staff of research engineers, is available for their estimates. They have a wide choice of machine tools for their recommendations, from a 4″ Plain Grinder to a 36″ Horizontal HydroTel Milling Machine with 120″ table travel. One of their typical analysis sheets is shown here . . . note that 24 of the operations are done on machines bearing the CINCINNATI trade mark.

Perhaps some of the parts in your own shop could be produced faster and on fewer machines. Send blue prints and sequence of operations to us, and our engineers will give you their recommendations.



PART NAME [redacted]
REQUIRED PRODUCTION - [redacted] PER HOUR

OPER.	NAME	PRODUCTION NOT COUNTING SET-UP	SKETCH	OUR ORDER NUMBER	MACHINE
1.	DRILL TWO 13/16 HOLES				X
2.	BURN OUT				X
3.	HEAT TREAT & BRINNELL				X
4.	ROH SLOT TO .845 TO 7.487 .851 TO 7.493	15½ PER MACHINE	PRINT E	41M-382569	THREE NO. 2-24 AUTO. RAP
5.	STRADDLE MILL SIDES & BOTTOM	25	2 ABREAST	--	NO. 3-24 PL. AUTO
6.	BROACH 1 SIDE BETWEEN EARS TOP OF TRUNION & 1 SIDE OF EARS		B-1854-E	41B-343307	
7.	BROACH TOPS OF EARS		B-1854-A	41B-343307	
8.	BROACH OPPOSITE SIDE-SAME CUT		B-1854-C	41B-343307	
9.	STRADDLE BROACH EARS-1ST. CUT		B-1854-D	41B-343307	
10.	STRADDLE BROACH EARS-2ND. CUT	33 PER MACHINE	B-1854-D	41B-343307	TWO NO. 10-66 DUPLEX BROACH
11.	FORM BROACH ENDS 1ST CUT		B-1854-E	41B-343307	
12.	FORM BROACH ENDS 2ND CUT		B-1854-E	41B-343307	
13.	STRADDLE BROACH EARS 3RD CUT		B-1854-D	41B-343307	
14.	BROACH BETWEEN TRUNIONS & EARS		--------	41B-343307	
15.	BROACH 1ST. CUT BETWEEN EARS & TOP STEP ° DEG. & 6 DEG. ANGLE 1 END.		B-1554-F	41B-343307	
16.	BROACH 2ND CUT BETWEEN EARS, LOWER STEP ° DEG. & DEG. ONE END, ANL 3 DEG. ANGLE OPPOSITE END.		B-1854-G	41B-343307	
17.	DRILL FOUR .393 HOLES, ONE 7/16" HOLE AND HOLLOW MILL TRUNIONS				X
18.	PROFILE CONTOUR OF EARS				X
19.	MILL BEARING PADS	87	PRINT C	41M-345187	NO. C-6 AUTO
20.	MILL 75 DEG. & 7 DEG. ANG. CUT	52 PER MACH.	PRINT B	41M-344256	TWO NO. C AUTO RAP
21.	MILL .394 X .079 SLOT IN EARS	40 PER MACH.	PRINT D	41M-344257	TWO NO. PLAIN AUT
22.	MILL .878 X .433 DIM.	52	RECIPROCATE	-------	NO. 1-12PL
23.	MILL .394 X .059 SLOT IN EA. SIDE	40 PER MACH.	PRINT A	41M-344256	TWO NO. AUTO. RA
24.	MILL 30 DEG. CUTS X .236 DIM.	40	RECIPROCATE	-------	NO. C-6 AU
25.	PROFILL .472 ELONGATED HOLE IN RIGHT END				X
26.	FINISH PROFILE 1.004 TO WITHIN .197 OF BOTTOM	15 PER MACH.	BC. MILL	41M-382569	TWO NO. AUTO RA
27.	PROFILE 1.496 AND .984 DIM.	31	BOX MILL	-------	NO. 2-24 RA
28.	PROFILE .118 CUTS	40	BOX MILL	-------	NO. 2-1 RA
29.	PROFYLE 1.004 AT BOTTOM			-------	
30.	DRILL .502 RAD. IN RIGHT END				
31.	REAM .492 RAD AND 1 DEG. 26' ANGLE				
32.	FORM CUT RADIUS NEAR TRUNION				
33.	POLISH EDGES ALL OVER				
34.	FILE WHERE NECESSARY				
35.	PARKERIZE				

CINCINNATI

Left: General Catalog, No. M-995-1. Contains illustrations and d densed information on complete line of CINCINNATI Mill Grinding, Broaching, Lapping and Cutter Sharpening Machi

TOOL ROOM AND MANUFACTURING MILLING MACHINES . . . SURFACE BROACHING MACHINES . . . CUTTER SHARPENING MACHINES

AUTOMOTIVE and AVIATION INDUSTRIES

Published on the 1st and 15th of the month

Vol. 89, No. 1
July 1, 1943

Tailoring American Planes to the Job

AMERICAN warplanes when assigned to any of the different operating fronts—to the South Pacific, Alaska, Africa or England—are modified and specially equipped to suit the climatic and special operating conditions they will encounter in these areas. In order to be able to make the needed modifications without slowing production lines, the American aircraft industry has established what are known as Modification Centers. Dozens of these Modification Centers are either in production or nearing completion in the United States, but so far as is known, the plan is not being followed in any other country in the World. In March President Roosevelt announced that about 30 Modification Centers were in operation at that time in various sections of the country. The first Modification Centers were established early in 1942.

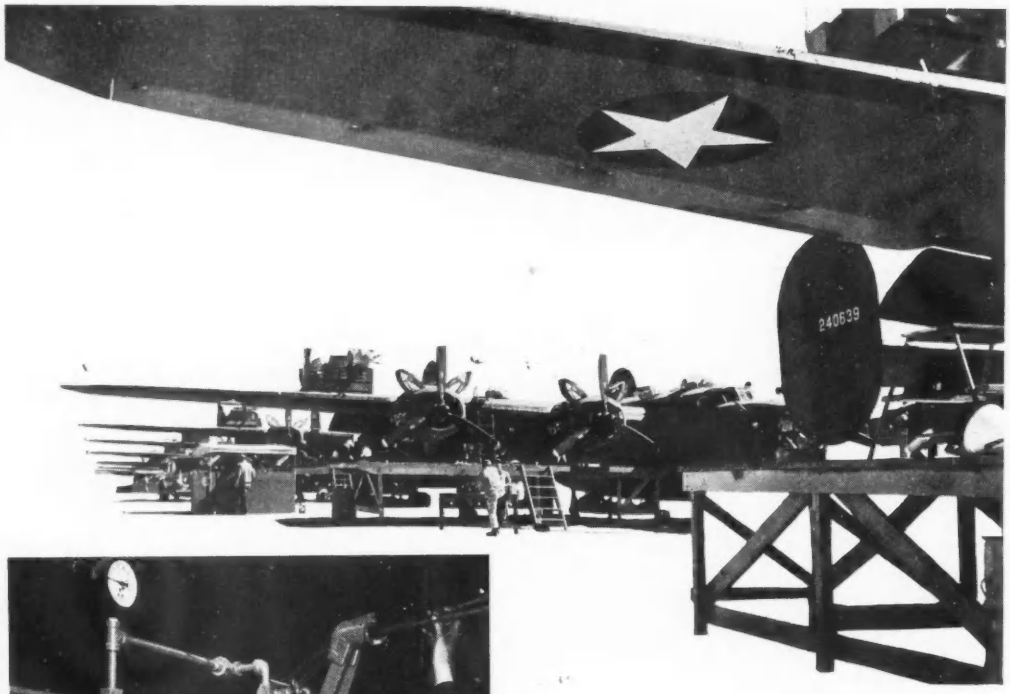
It is confidently asserted that because of these Centers, aircraft manufactured in this country will not fail on any front, as the Luftwaffe did on the Russian front during the winter of 1941-42. The combined production of these vital centers—not that of the parent factories—is the military aircraft production of the United States.

When a warplane rolls off the factory assembly line, it is not yet known where it is going to be needed most and under what conditions it must operate, for which reason it cannot be put in shape in the factory for immediate action. So it is flown to a Modification Center, where it is "weatherized" and otherwise equipped for specific theaters of operation or special missions. Exactly what is done to them there is a military secret, but how it is done can be told—in part at least.

Orders for modifications are received from all fronts by the Special Projects Branch, Production Division, of the Materiel Center, Wright Field. There they are studied and, if practicable, are forwarded to the Modification Center handling the model or type of plane involved. Changes are those that men at the fighting fronts believe will improve the operation and destructive ability of the planes.

An order may include many changes. Some of them may eventually become a routine installation on the assembly line of the parent plant, while others may always have to be made at the Modification Center. It is estimated that 25 per cent of the changes will always be what is now called "permanent"

P-38 fighters on the modification line at the Lockheed-Vega Center in Dallas, Texas.



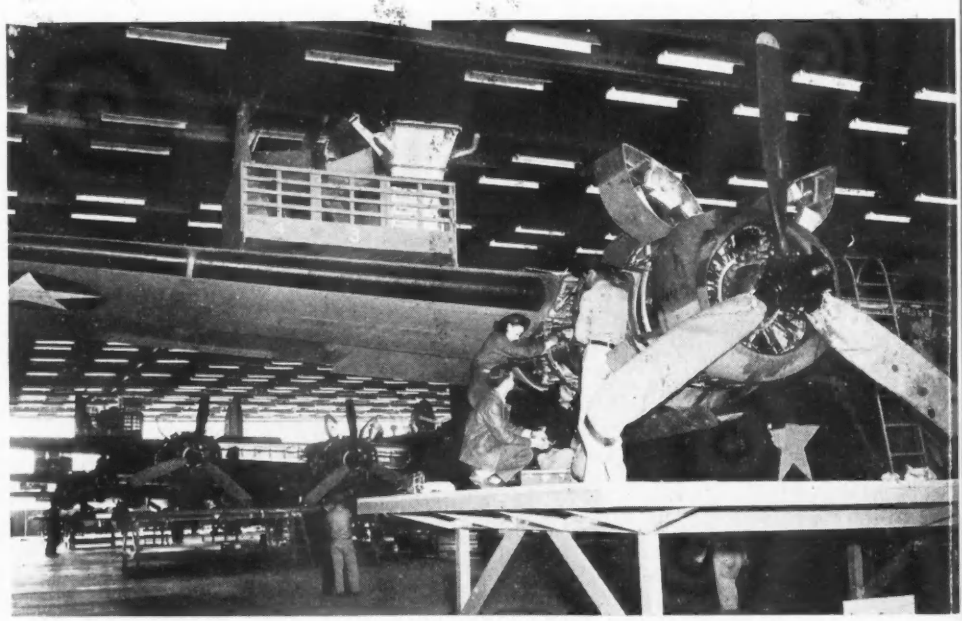
Consolidated also operates a complete outdoor production line at its Tucson modification center. Portable evaporative coolers are installed in the bombers to maintain comfortable working conditions.

At the Consolidated Vultee Modification Center this 60-ton hydraulic press, which was purchased from an automotive supply firm, is used to form brackets. The female die is made of hardwood.

Modification Center work, such as winterization installations, and 75 per will be of a "temporary" nature, handled by the Center only until the parent plant can put them into production.

For the latter, the Modification Center engineering department makes drawings that will put the change into production at the Center, and then sends copies to the parent plant. There, work will start immediately to incorporate the change on the production line. The Center will continue to fabricate and install the change until it comes through permanently from the parent plant. But by then still other changes will very likely have been ordered, and will be in progress at the Center. It is believed that this routine will continue throughout the war. Installation of weatherization and special-mission equipment will always be done in the Modification Center.

For the first change installation, the engineering department makes rough sketches, to be followed later by drawings, and the Center's tooling and methods departments then go into action.



Changes to Liberators are made at the Consolidated Vultee Modification Center at Tucson, Ariz. Removed parts are carried along in ships in racks atop the wings and are installed later when the ships reach the final stations.

Tooling in most instances is of the "quick and rough" variety, for the goal is to get into production fast, but generally for small quantities, as compared to production at the manufacturing plant.

Generally it is only a matter of a few hours until tools are made and methods of producing the new parts or equipment put into operation. Production, as in the early days of the industry, is necessarily almost exclusively by hand methods—"quick and a bit rugged" describes it. In some instances Centers have gone back 18 years for a method to make a part, producing it exactly as then by methods now considered primitive and long since abandoned.

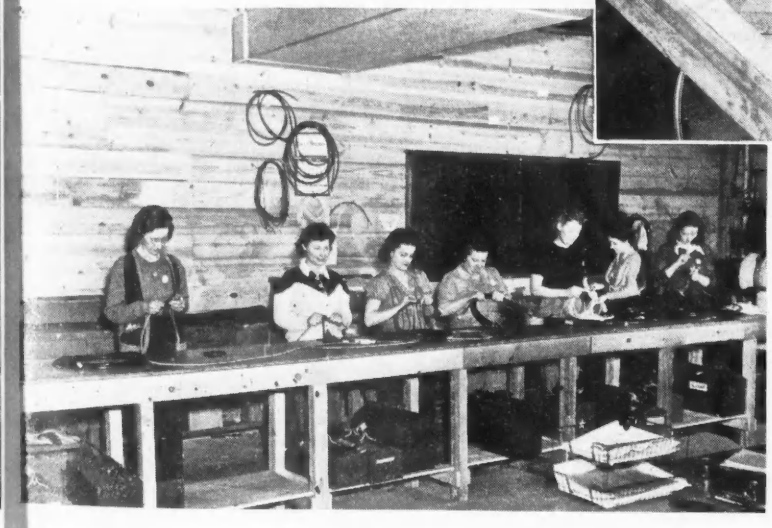
At the Consolidated Vultee Aircraft Corporation's Tucson, Ariz., Modification Center, B-24 Liberators are assigned project numbers as they arrive from the manufacturing plant, flown in by company ferry crews. The changes and installations to be made on each ship are carried on an order which accompanies the ship as it moves through this center.

Dispersed about the landing field adjoining the Modification Center hangars, planes await assignment. When assigned, they are taxied to the reception ramp at the head of the modification line. While still outside the huge hangar buildings, and prior to entering the line itself, fuel, alcohol, and oil are removed, and engines are drained, cleaned, and treated to prevent corrosion.

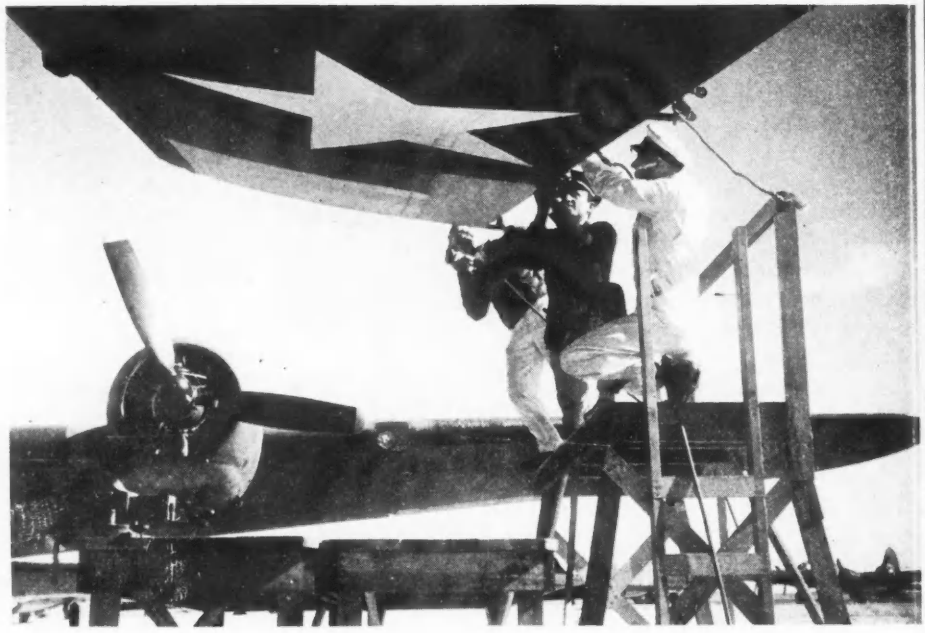
At the first station of the line all loose equipment, particularly that inside the fuselage compartments, is removed, tagged, and stored in a special box, which is then moved to a specific station farther down the line, where it will be reloaded when the ship arrives there.

At one of the first stations, cowling racks, made of plywood, with solid bottoms and ends and slat sides, are fastened to the upper surfaces of the outer wings, two to each ship. As cowlings and parts are removed so modification work can be done, they are placed in these racks and remain there throughout the trip down the line. Each rack has three compartments, and these are specified for certain uses. Through this method, parts are always found in the same place when needed, and the possibility of damage due to improper handling and jamming in the crates is avoided.

As on the assembly line of the producing plant, work on the modification line is broken down into its logical segments, each to be accomplished at a given station on the line. In setting up the line



Here are three views at the Modification Center of the Bell Aircraft Corp. where Airacobras are prepared for special missions and combat. In addition to the modification lines (top), the center contains a welding shop (above), radio and electric shop (left), paint shops, machine shop, sheet metal shop, riveting shop, wood working shop, and others.



Flying Fortresses receive last-minute changes at the Cheyenne, Wyo., Modification Center operated by United Air Lines.

and in all other phases of work, whether fabrication, installation, or reassembly, methods used by the producing plant are drawn upon for ideas and timing. It has been found that holding to approximately the same time interval per station as that allotted in the parent plant, best dovetails the modification line with that of the source plant. However, the work done requires only about one-third the time, and one-fortieth the man-hours required to build the plane. These ratios are expected to change as other units of the Center are occupied and the personnel acquires greater skill.

Nucleus staffs were drawn from other Consolidated plants for every department of the Modification Center. Around these were added staffs drawn from the community near the Center. Much of this personnel, with the exception of a few skilled mechanics, machinists, electricians, and the like, was inexperienced. Company training classes have been set up for new employes, who are paid while being trained and who are moved into the Center as rapidly as possible. New workers are taking to aircraft techniques readily, and no difficulties are anticipated in maintaining the steadily-increasing production rate planned.

As in all war plants today, the labor problem boils down to "how many jobs can women handle?" The Tucson Modification Center has found the percentage to be about the same as that of the producing plants.

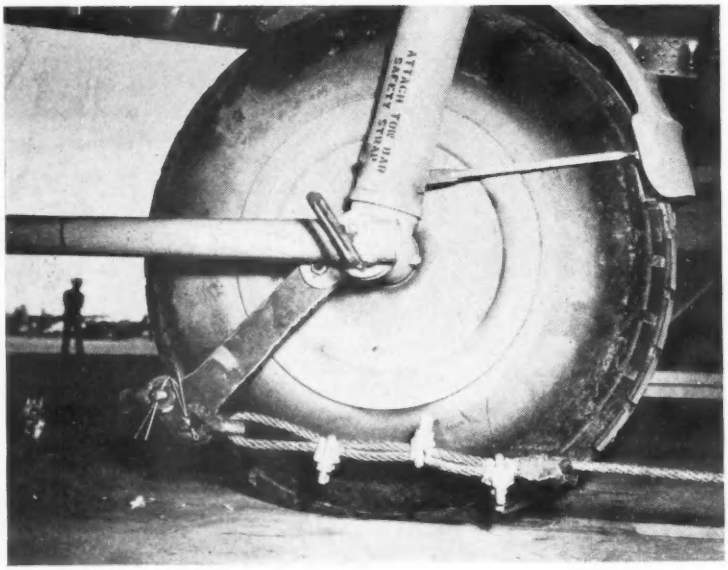
B-24 Liberators are moved on their own wheels along the assembly line by towing them, linked together by a single cable extending from nose wheel to nose wheel, with a tractor. Stations are stationary work stands arranged so that the fuselages pass between them, and port and starboard wheels move through slots from which leaves in the floor of each stand have been removed. Because of the nature of the work, only one-eighth as many workers can be used per station as are used at the average station of the parent plant's assembly line.

In fabrication departments, workers must be resourceful. The job must be done as quickly as possible and in such a manner as to meet the deadline set in the order. The Modification Center does just that. The job may be done by forming parts on a 60-ton hydraulic press which the Tucson Division acquired from a wholesale automobile supply concern, or with a die of hardwood, and one accepted part as a pattern, the required number of parts may be rushed to completion.

Stock for some part may be cut with tin snips, hand-formed over maple blocks, and burred with pieces of disc-type knife sharpeners picked up at the ten-cent store. Parts requiring machining frequently are produced on small bench and tool-room lathes.

The Modification Center is looked upon as an extension of the parent plant. Its staff must not only be resourceful, but must include a large percentage of people who are all-around craftsmen. Its work cannot be standardized, and its methods, equipment,

(*Turn to page* 82, *please*)

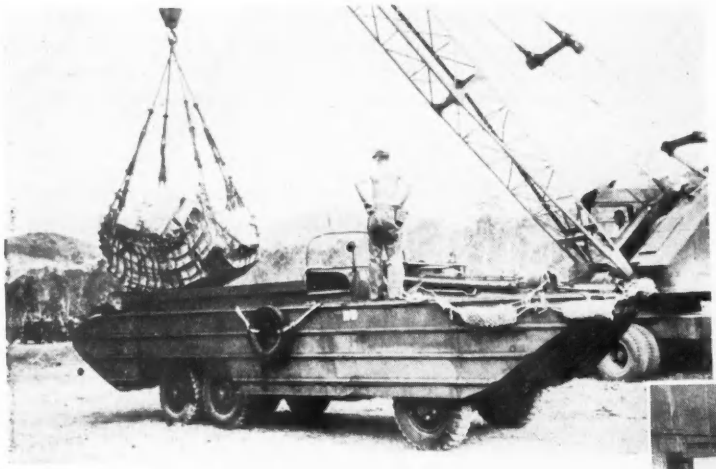


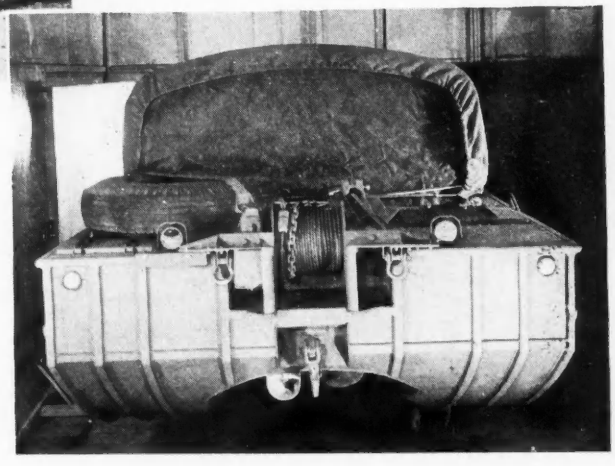
This towing device, which is used on the Liberator modification line, is designed so that the pull is from cable to cable rather than through the nose wheel axles. With the pull relaxed, the cable and steering bar lie on the floor.

Army's Amphibious Truck

(Top)
This amphibious military vehicle, which is being built for the Army by General Motors Truck and Coach, is driven in the water by a rear mounted propeller. The shafts to axles and propeller pierce the hull through sealed tubes and the propeller thrust can be augmented by driving the wheels at the same time. The steering gear is connected with the rudder linkage so that the steering wheel can be used to steer the vehicle in the water. This photo shows some of the trucks making a landing in New Caledonia. (Acme photo).

(Below)
This rear view shows the vehicle with the top up. At the center is located the power-driven winch.





(Oval)
This amphibian is not designed as a combat vehicle, but is intended for invasion purposes where shoals and sand banks are encountered, and also in forcing river crossings. A water tight steel hull encases the frame assembly, below which is mounted the suspension system, axles and wheels. The chassis, equipped with a standard 6-wheel drive, is essentially the same as used on the Army's 2½-ton 6 x 6 cargo truck. (British Combine photo).

(Above)
The Army DUKW-353, which has been christened "The Duck," has an overall length of 31 feet, a width of 8 feet, and a height of 7 feet with the top down. On the highway maximum speed is over 50 mph, in the water over 6 mph. Wheelbase is 164 in. and dry shipping weight 14,100 lb.

Gear Sets *for Medium Tanks on the*

WHAT was one of the latest and most modern of the passenger car rear axle plants just before Pearl Harbor is now one of the finest of the medium tank transmission producers, marking still another phase in the conversion-to-war program of the Buick Motor Car Division, General Motors Corp.

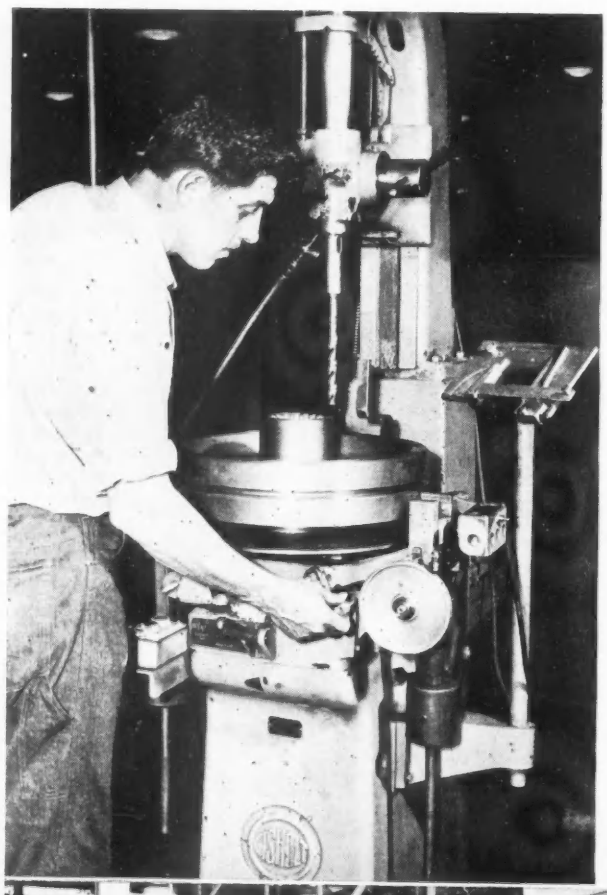
It will be recalled that Buick pioneered many important advances in axle and transmission gearing over the years. This know-how has been applied with signal success to the building of huge tank transmissions. It touches upon heat treating techniques, gear cutting procedures, selection of manufacturing equipment, development, quality control, and the host of other activities that go to make up a modern gear producing unit.

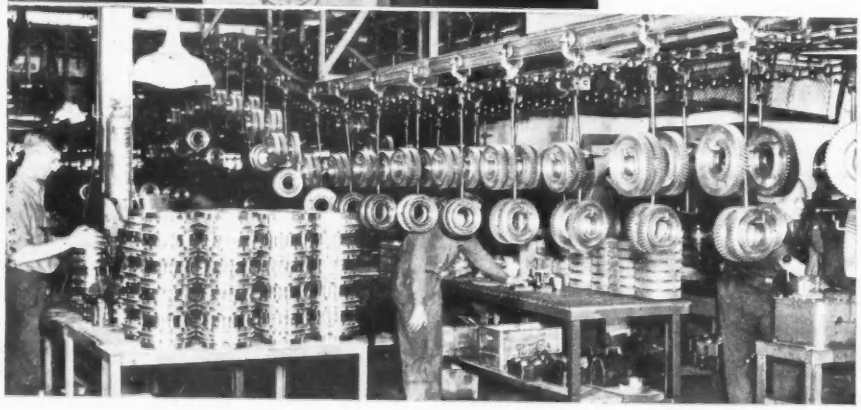
The tank power train manufacturing setup is divided into two major sections—the gear and heat treating plants; the miscellaneous parts, heavy case, and assembly plant. The latter contains some of the largest machine tools to be found in the industry—all special purpose equipment designed for the various machining operations on the transmission case and covers. Among these are Cincinnati Hydro-Tels of single-spindle type, huge Ingersoll milling machines, Natco multiple-spindle drilling machines, including one that drills 132 holes in one setting; extremely long horizontal boring machines made by W. F. & John Barnes, and by Snyder; and a variety of other machinery.

The gear department was selected as the subject of this brief study not only because of the general interest in gear problems but also because of the importance of Buick's contribution to the program. To visualize the versatility of the operation consider that the gear department produces a huge herringbone final drive set consisting of the drive gear and pinion; a large spiral bevel (Formate) gear and pinion set; a variety of spur and spiral gears; extremely large input and output shafts; synchronizer unit of enormous proportions when compared with passenger car practice; and the gamut of other parts that comprise the gear set of the medium tank.

Due to the obvious complexity of the setup it is difficult to generalize on its activity and quite impossible to cover even its major steps within the compass of a brief article. Accordingly, we have singled out a few of the major parts for special attention and as examples of the character of the operation.

It may be noted at this point that the Formate gear set is produced on a battery of Gleason generators of the latest type—roughing from the solid in one setting, finishing on another machine. Buick is currently tooling for a still larger





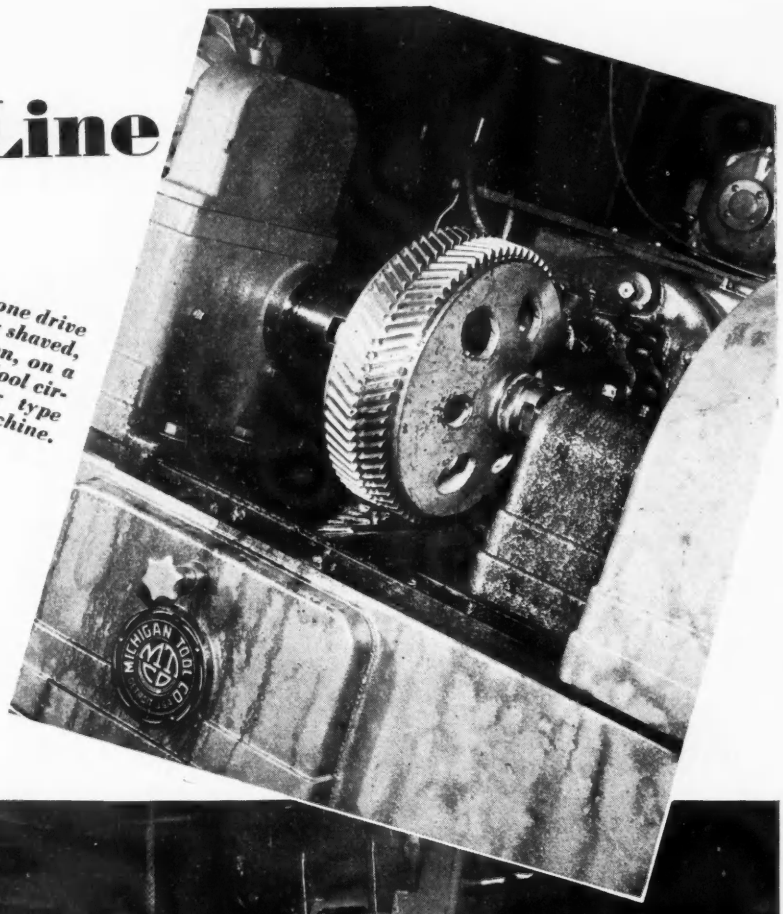
(Top) Herringbone drive gear blanks are statically balanced on a Gisholt balancer before having the gear teeth cut.

(Bottom) Where automotive methods persist in war production. Intimate view of long monorail conveyor line in gear plant transports gears and other parts of the tank transmission, through inspection and to assembly.

Production Line

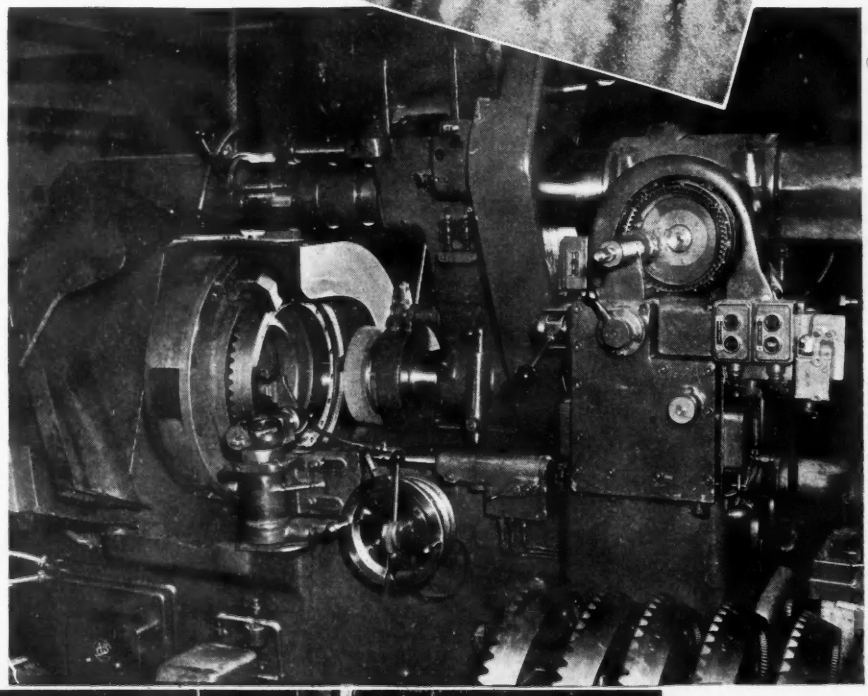
By Joseph Geschelin

transmission in which both the gear and pinion will be finish-ground on the new Gleason Formate grinder. Herringbone gears are cut on large Fellows gear shapers in four different settings—roughing of each side of the herringbone in two settings, finishing in two settings. Splines and gears on the several shafts are produced on G & E hobbers and Cleveland Rigid-hobbers. Wherever feasible the gears are shaved in the green on Red Ring or Michigan Tool shaving machines.

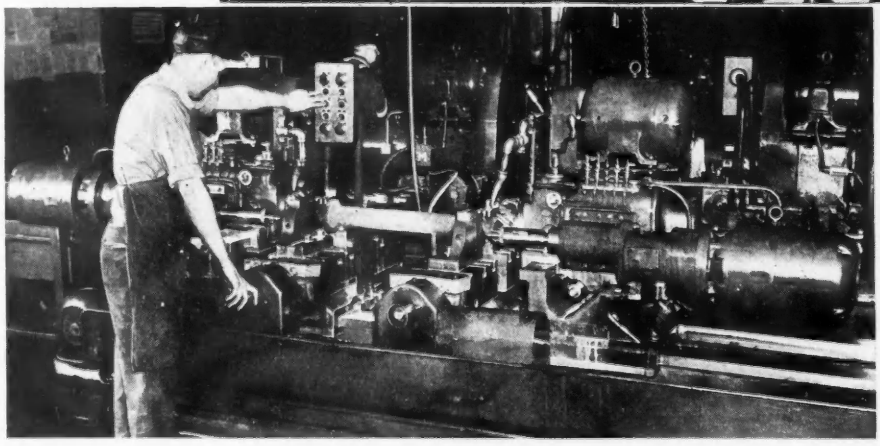


Herringbone drive gear being shaved, in the green, on a Michigan Tool circular cutter type shaving machine.

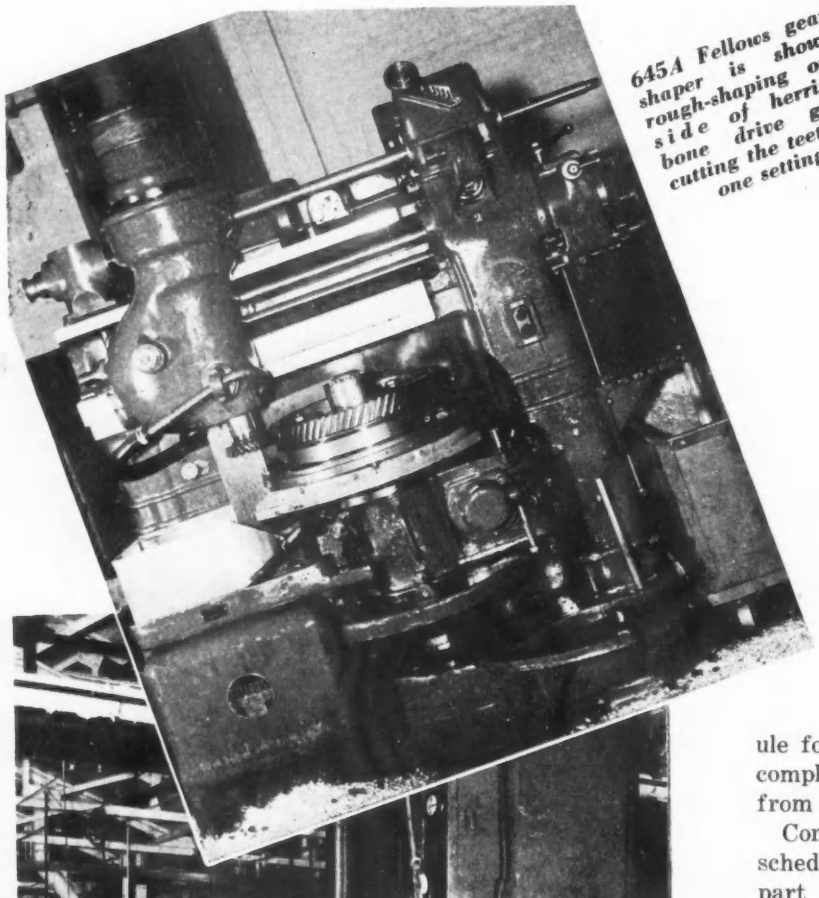
This is the Eighty-third in the series of monthly production features



This huge Bryant internal grinder handles the finish-grinding of the bore in the bevel ring gear.



Doubling in brass, this Sundstrand double-end machine is a combination milling and centering setup, in which the shaft is, first, milled to length, then centered, employing a two-station fixture for the purpose.

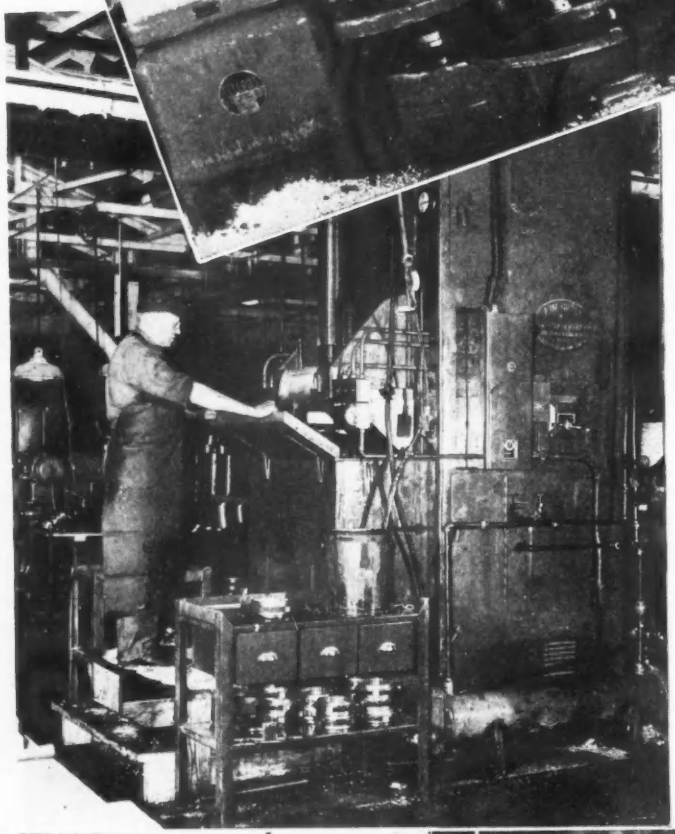


645A Fellows gear shaper is shown rough-shaping one side of herringbone drive gear, cutting the teeth in one setting.

Generally speaking, pinion blanks for herringbone and bevel gear sets are machined on Bullard Mult-Au-Matics while the large gears and rings are turned on big Foster Fastermatics. Massive 8-in. Lo-Swing automatic lathes and Fay automatic lathes are used for machining the shafts.

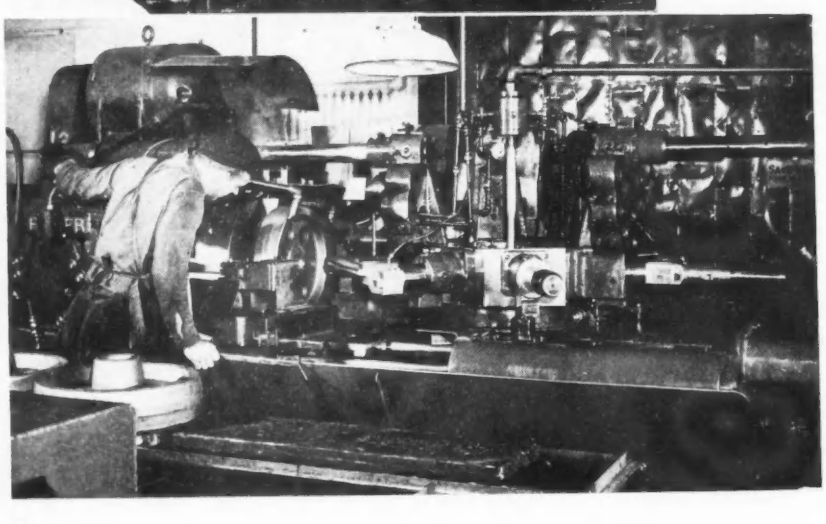
Buick has been noted as a pioneer in metallurgical development in the era before the war. They exploited advanced methods of heat treatment such as the use of gas carburizing furnaces, and the coordination of heat treating techniques with machine shop practice. All of this background has been impressed on the tank transmission project. Not the least of the problems introduced in this operation is that of control of fire distortion due to the size and mass of tank gearing. For one thing the variables due to size and form have made it necessary to establish a unique heat treating schedule for each individual piece. Even this setup is complicated and disturbed by variations in steel from different heats.

Consequently, Buick has established a continuous schedule of metallurgical laboratory control as a part of the heat treating operation. Sampling tests are made of every type of gear with suitable instrumentation in the gear laboratory. Readings are taken in the green and after heat treatment to detect variations in dimensions, particularly for each new heat of steel. The resultant spot checking is used to establish the corrections that must be made in the quenching operation to compensate for dimensional changes or tendency to distort. To this end there are a variety of plugs from which a selection is made in accordance with the estimated correction, the plugs and quenching fixtures for the Gleason quenching machines being constantly changed to meet variations arising from inspection runs of gear laboratory samples.

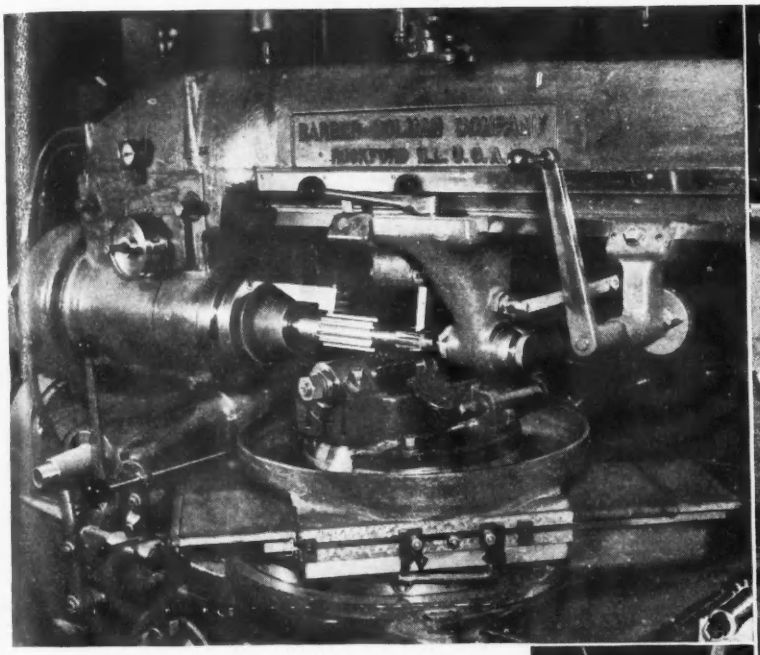


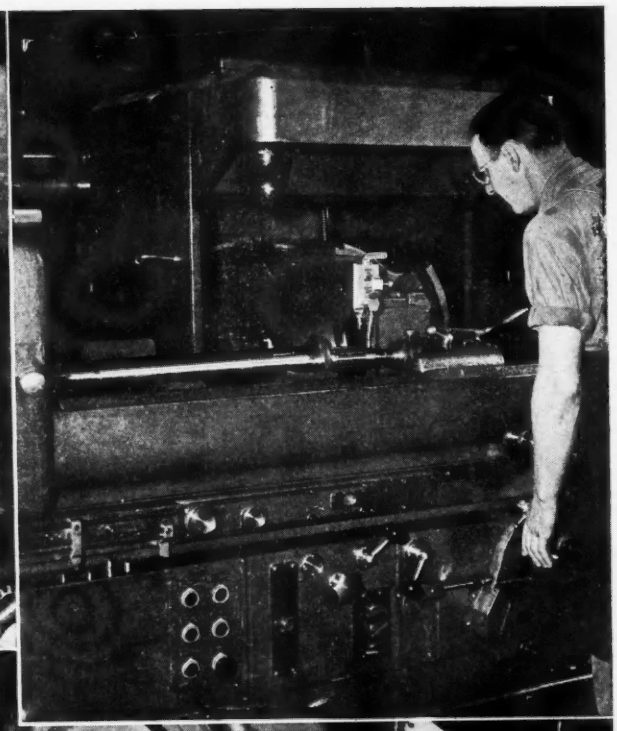
Standing ceiling high, this American broaching machine forms the internal splined bore of the "dog-collar."

This procedure in the heat treating department exerts a basic influence upon the machining of gear blanks. To take the large herringbone gear as an example, it is noted that the side of the rim and the face of the short hub boss on one side



Foster Fastermatic turret lathe handles turning and facing operations on the herringbone gear blank.



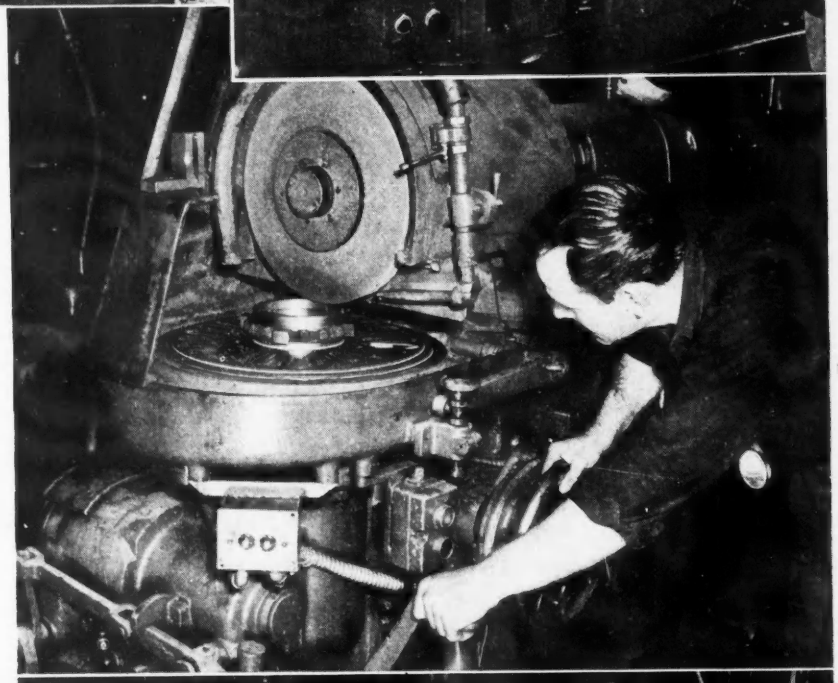


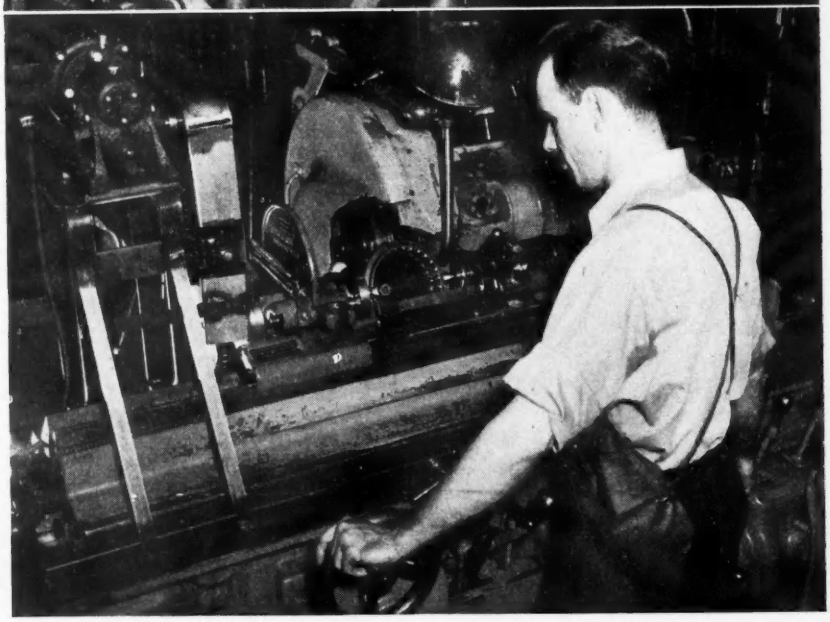
(Above) Close-up of the business end of one of the large Barber-Colman hobbing machines.

(Top, right) Ex-Cell-O thread grinder, one of a battery, cutting thread on the end of one of the transmission shafts.

of the blank are held to extremely close tolerances with respect to one another, and finish-ground, primarily to provide accurate seating in the Gleason quenching fixture. This operation, therefore, marks one aspect of the coordination of metallurgical control with machine shop practice.

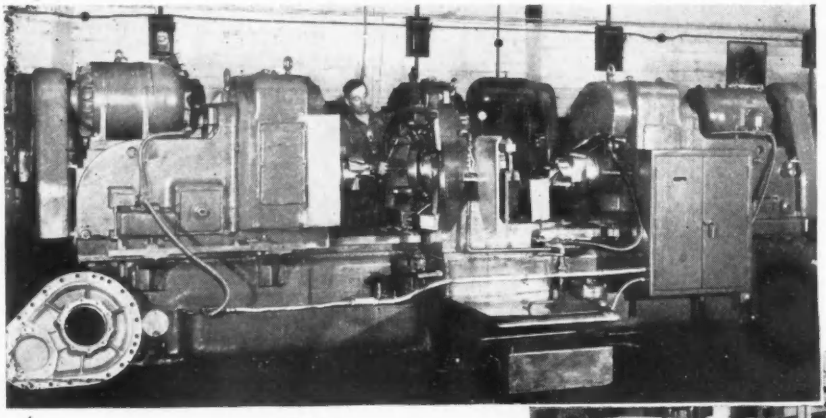
Because of the effects of fire distortion on large masses of metal, even the foregoing procedures are not accepted as being positive proof of conformity to specifications. Certain quality controls are introduced into the process to assure satisfactory performance. For example, each gear is checksd after carburizing, then after hardening to make sure that it is suitable for





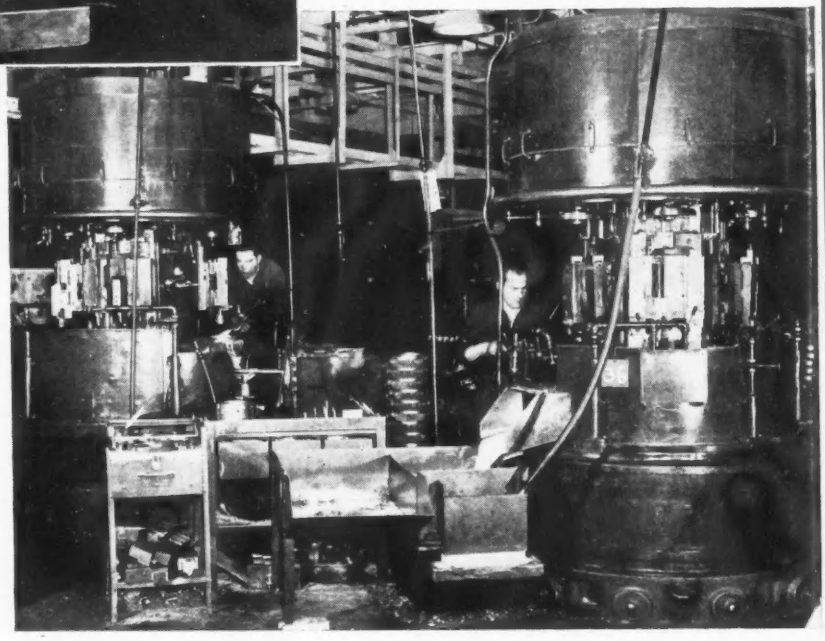
(Center) "Dog-collar" hub face being finish-ground on a Heald rotary surface grinder.

(Right) Here is an unusual operation. A 10 x 36 Norton cylindrical grinder fitted with a Special Ohio Units cam-grinding attachment, finish-grinds the hexagon; shaped trunnion, in one setting, one trunnion at a time.



(Left) Another of the big machines in the case department is the special W. F. & John Barnes horizontal boring machine, one of several installed here.

(Below) Towering Bullard Mult-Au-Matics are a feature of the plant. Here is a close-up of part of a battery of 6-spindle Bullards in the gear department.



quenching. This makes possible a last minute correction in the quenching machine to compensate for unexpected variation.

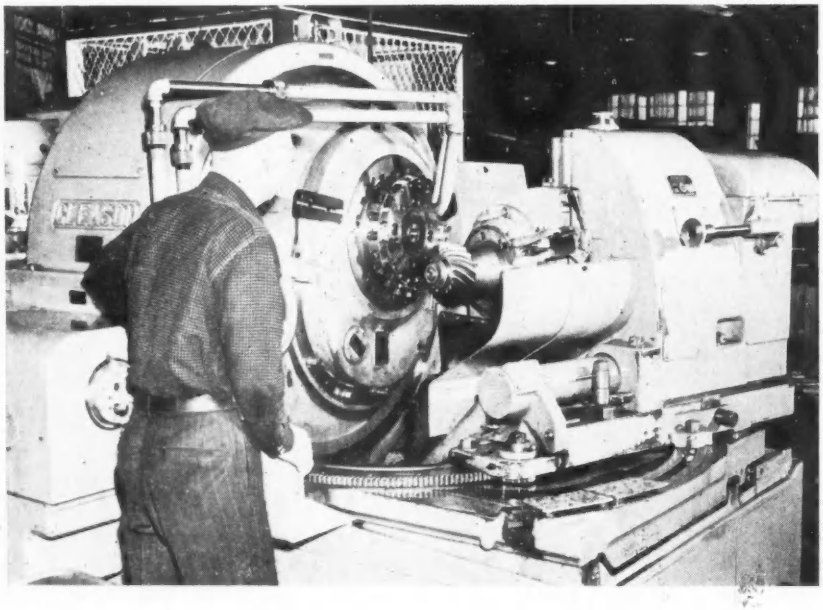
Finally, it may be observed that under war-time conditions even the elaborate setup outlined above may have to be radically altered. At present writing the procedures are being overhauled due to the shift to NE 8620 steel which is replacing the AISI alloy steel formerly used.

With this brief introduction, consider several specific examples of gear production. Let us touch, first, on the large spiral bevel drive gear. The forged blank is chucked on the OD in a 4-F Fastermatic turret lathe for rough-boring and rough-facing, then finish-boring, facing, forming. Then it is held from the finished bore in another Fastermatic for rough and finish facing and taper turning of the gear face. Tooling on these machines includes H-S-S cutters, Stellite boring and forming tools, and a Carboloy-tipped undercutting tool. Following the drilling and tapping of 18 holes, the bore is green ground on a 16-A-28 Bryant internal grinder and the face angle ground on a Heald rotary grinder.

Next comes gear cutting. The internal gear—spur teeth—is shaped on a 615-A Fellows gear shaper; the the spiral bevel gear is rough cut out on a ‡22 Gleason rougher, chamfered on a Cross machine, finish-cut on a Gleason finisher. The gear is soft-tested in a Gleason testing machine, then transported for heat treatment, where it is carburized and hardened, quenched, washed and drawn, cleaned and inspected.

The bore is ground on a Bryant internal grinder, then the gear and pinion are matched in the Gleason testing machine, and matched pairs lapped in the Gleason lapping machine. Final operation is that of Lubricote plating—a heavy copper coating which prevents scuffing during run-in when installed in the tank.

The herringbone final drive gear, the second example, starts as a large

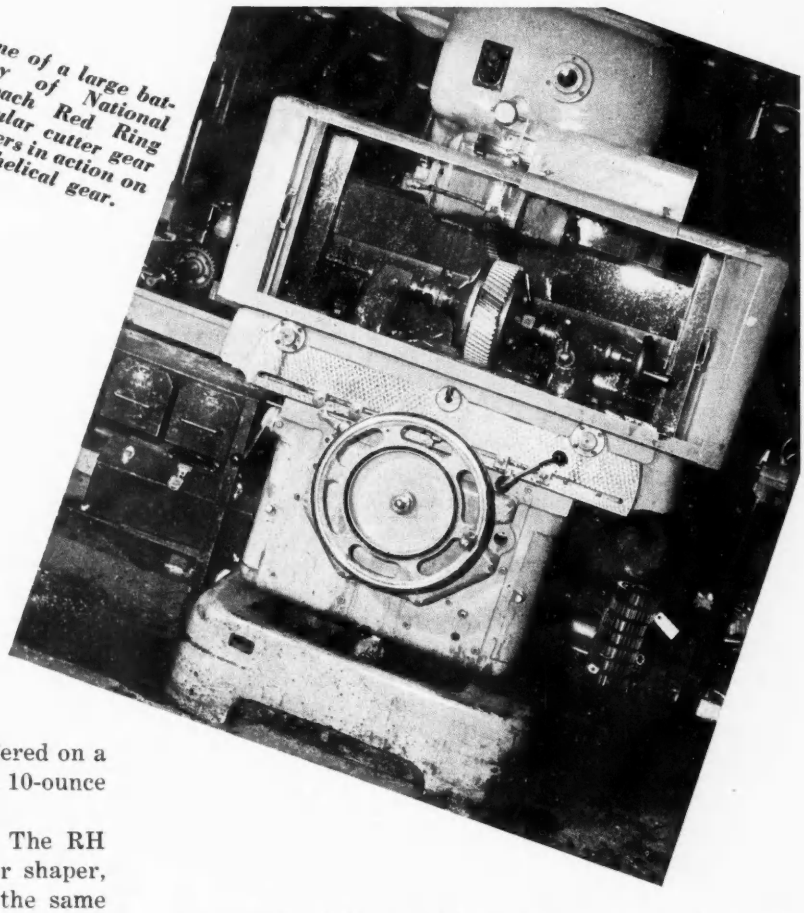


Latest type Gleason Formate finisher finish-cutting drive pinion teeth.

forging, takes about 34 operations to complete. First operation is that of core-drilling six 3-in. holes on a No. 314 Baker drill press. The blank is then chucked on the ID of the flange in a 4-F Fastermatic turret lathe for core-drilling, rough- and finish-boring of the hub, rough- and finish-facing of the rim, and rough turning of the hub OD. A horizontal Oilgear broaching machine is used for broaching the splined bore. In preparation for alinement in the quenching fixture, the short hub face and rim on the same side are ground on a Heald rotary surface grinder in one setting.

The gear is loaded on a plug in the bore, chucked in the 3-in. holes, mounted on a Fastermatic turret lathe for the various roughing and finishing operations on the blank in a five-station cycle. The rim on the long hub side is ground on a Heald rotary grinder, both ends of the spline chamfered on a Cross machine, then the blank is balanced to 10-ounce inches on a Gisholt static balancer.

Next major operations are gear cutting. The RH teeth are rough cut on a 645-A Fellows gear shaper, finish cut on the same type machine; then the same sequence for the LH teeth. The edges of the teeth are chamfered in four separate operations on Cross machines. The RH and LH gear sections are shaved in separate settings on a Michigan Tool rotary cutter shaving machine.



One of a large battery of National Broach Red Ring circular cutter gear shavers in action on a helical gear.

The next stage is the gear lab. Here the gears are checked on the Fellows Red Liner, the Illinois helical lead checker, the Illinois normal pitch measuring machine, Illinois involute profile measuring machine, Red Ring gear speeder, Vinco optical master inspection dividing head, and finally run-in on the Gleason gear tester.

From the gear lab, the gears go to the heat treat for gas curburizing in Surface Combustion continuous furnaces, quenching in Gleason machines, wash, draw, shot blast, and inspection.

Final stage is hard grinding. The OD of

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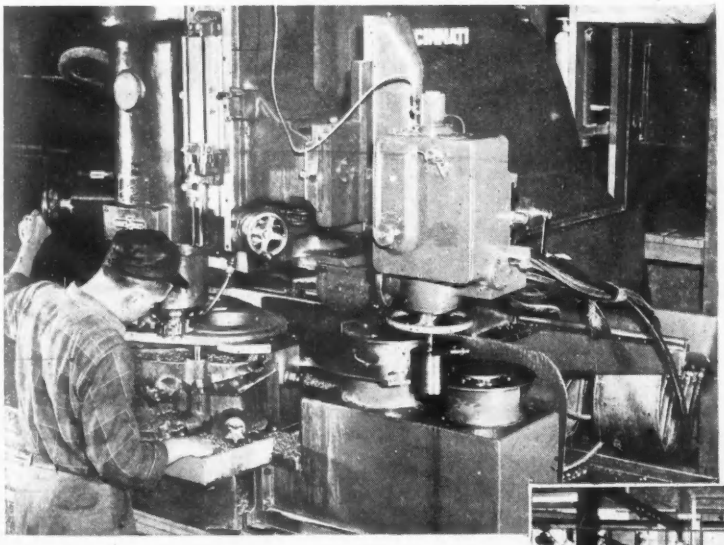
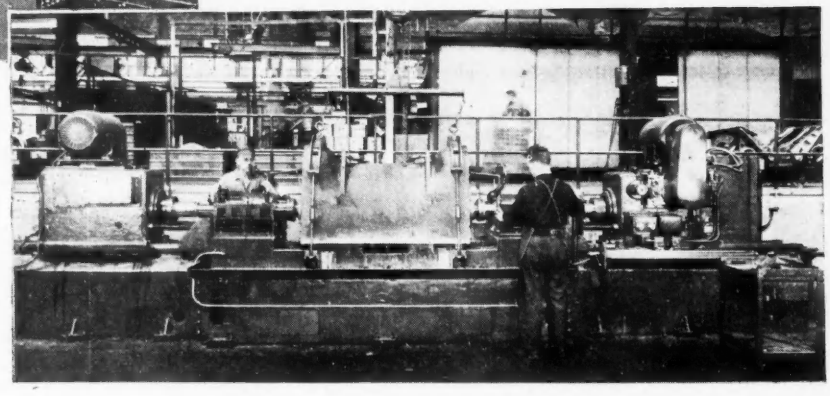


(Above) Single-spindle Cincinnati Hydro-Tel, one of a large battery, speeds the task of face milling irregular faces of housings and covers in the gear case department.



(Right) Among the giant machines in the transmission case department is this special Snyder horizontal boring machine. The lifting tackle for the case may be seen in place.

Production Illustration as

PRODUCTION Illustration, as a co-ordinated system of explaining and defining manufacturing procedures in a language of pictures instead of words, was an outgrowth of war production during World War I. Since then it has been fostered and developed largely through the efforts of a relatively small group of enthusiastic specialists headed by George Tharratt, under whose supervision the first large scale application of "P.I." to mass production was made in the plants of the Douglas Aircraft Co., Inc., in 1937. In the co-ordination of illustration with the several phases of the Douglas operations, and later when applied to the operations at Lockheed, Boeing, Bell and other aircraft plants, four basic phases of Production Illustration were developed. As outlined by Mr. Tharratt in his paper before the Society of Automotive Engineers (see *Automotive Industries* — Dec. 15, 1941), these four phases are as follows:

Phase I—
Development of the Original Perspective.
Production Breakdown Drawings.

Phase II—
Structural Units Drawings.
Functional or Systems Illustrations.
Vendors' Drawings.

Phase III—
Sub-assembly and Assembly Drawings.
Job Illustration.

Phase IV—
Assembly Changes. (The usefulness of the Sub-assembly and Assembly, and Job Illustration drawings is entirely dependent on their being up-to-date and absolutely correct. Therefore, it has proven necessary to the success of the P.I. program to have a well-organized change procedure which can cope with any and all changes on the assembly lines.)

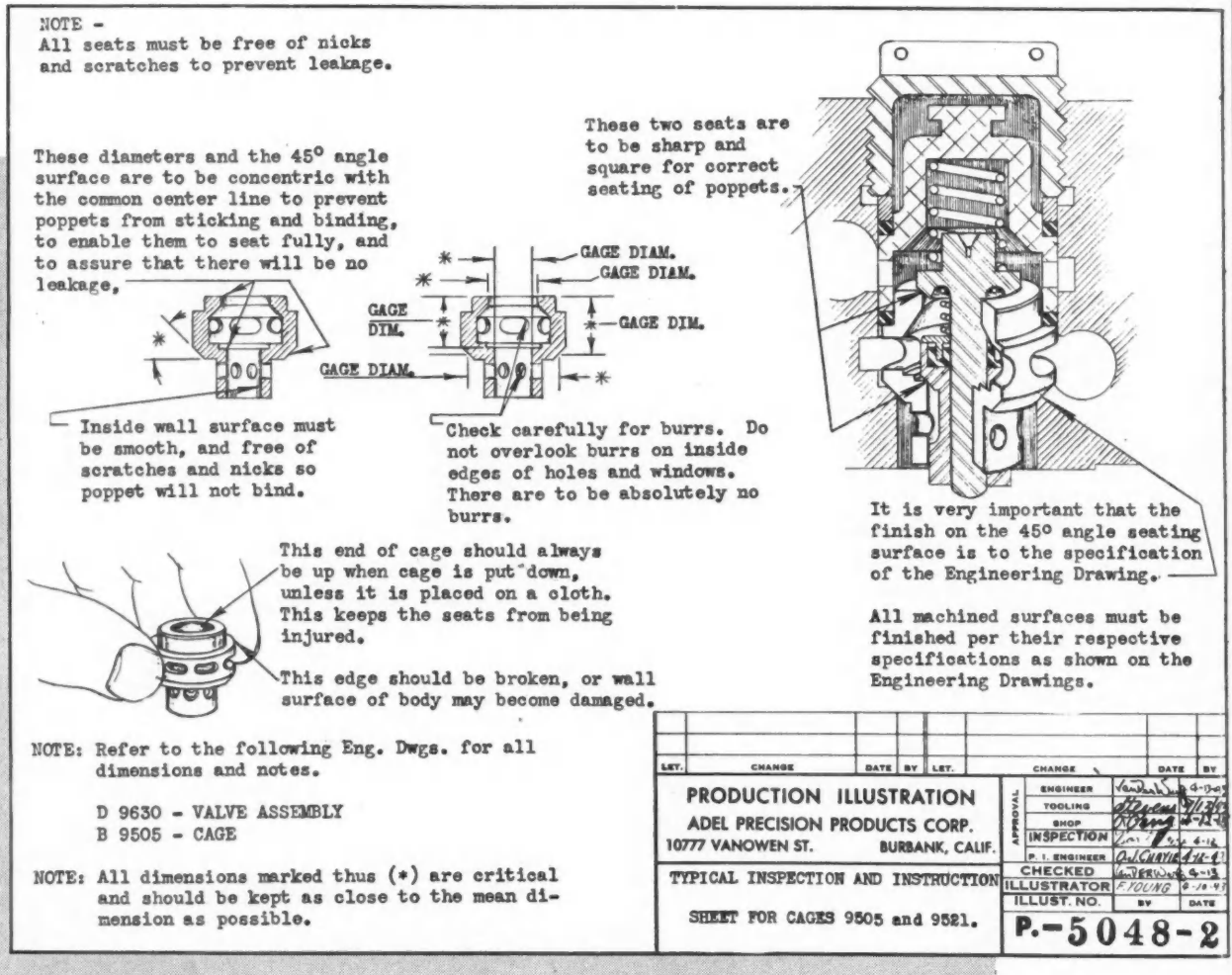

NOTE -
All seats must be free of nicks and scratches to prevent leakage.
These diameters and the 45° angle surface are to be concentric with the common center line to prevent poppets from sticking and binding, to enable them to seat fully, and to assure that there will be no leakage.
GAGE DIAM.
GAGE DIAM.
GAGE DIM.
GAGE DIM.
GAGE DIAM.
Inside wall surface must be smooth, and free of scratches and nicks so poppet will not bind.
Check carefully for burrs. Do not overlook burrs on inside edges of holes and windows. There are to be absolutely no burrs.
These two seats are to be sharp and square for correct seating of poppets.
It is very important that the finish on the 45° angle seating surface is to the specification of the Engineering Drawing.
All machined surfaces must be finished per their respective specifications as shown on the Engineering Drawings.
This end of cage should always be up when cage is put down, unless it is placed on a cloth. This keeps the seats from being injured.
This edge should be broken, or wall surface of body may become damaged.
NOTE: Refer to the following Eng. Dwgs. for all dimensions and notes.
D 9630 - VALVE ASSEMBLY
B 9505 - CAGE
NOTE: All dimensions marked thus (*) are critical and should be kept as close to the mean dimension as possible.
LET. CHANGE DATE BY
PRODUCTION ILLUSTRATION
ADEL PRECISION PRODUCTS CORP.
10777 VANOWEN ST. BURBANK, CALIF.
TYPICAL INSPECTION AND INSTRUCTION SHEET FOR CAGES 9505 and 9521.
APPROVAL
ENGINEER
TOOLING
SHOP
INSPECTION
P. I. ENGINEER
CHECKED
ILLUSTRATOR F YOUNG
ILLUST. NO. P.-5048-2

Figure One

Applied to Precision Parts

By Raymond Kay

The P.I. program has thoroughly proven itself in the production procedures of several of the large manufacturers of aircraft and other large and complicated units of military equipment. Upon taking office as Chief Engineer of the Adel Precision Products Corp. and making a study of their methods and products, it became evident to Mr. Tharratt that not only was a comprehensive program of Production Illustration necessitated by the large scale production of small-unit, high precision products now called for by aircraft manufacturers and government agencies, but that some specialized types of P.I. would be required. In consequence, O. J. Chayie was appointed supervisor in charge of ADEL's newly established P.I. department, with instructions to make an intensive study of the production peculiarities of the factory and to lay out a program for the illustration of its manufacturing procedures.

In consideration of that study and in the light of an extensive experience in both the practice and the teaching of production illustration, a definite program was formulated that has since been put into effect as rapidly as permitted by the local scarcity of personnel capable of making not only the illustrations themselves, but also conducting the investigations into factory operations necessary to provide the basic information upon which the illustrations are formulated.

The products to be illustrated are, as aforesaid, relatively small units involving extremely accurate production of the component parts, and their almost equally accurate assembly, plus exacting inspection and test all along the route from stock room to shipping dock.

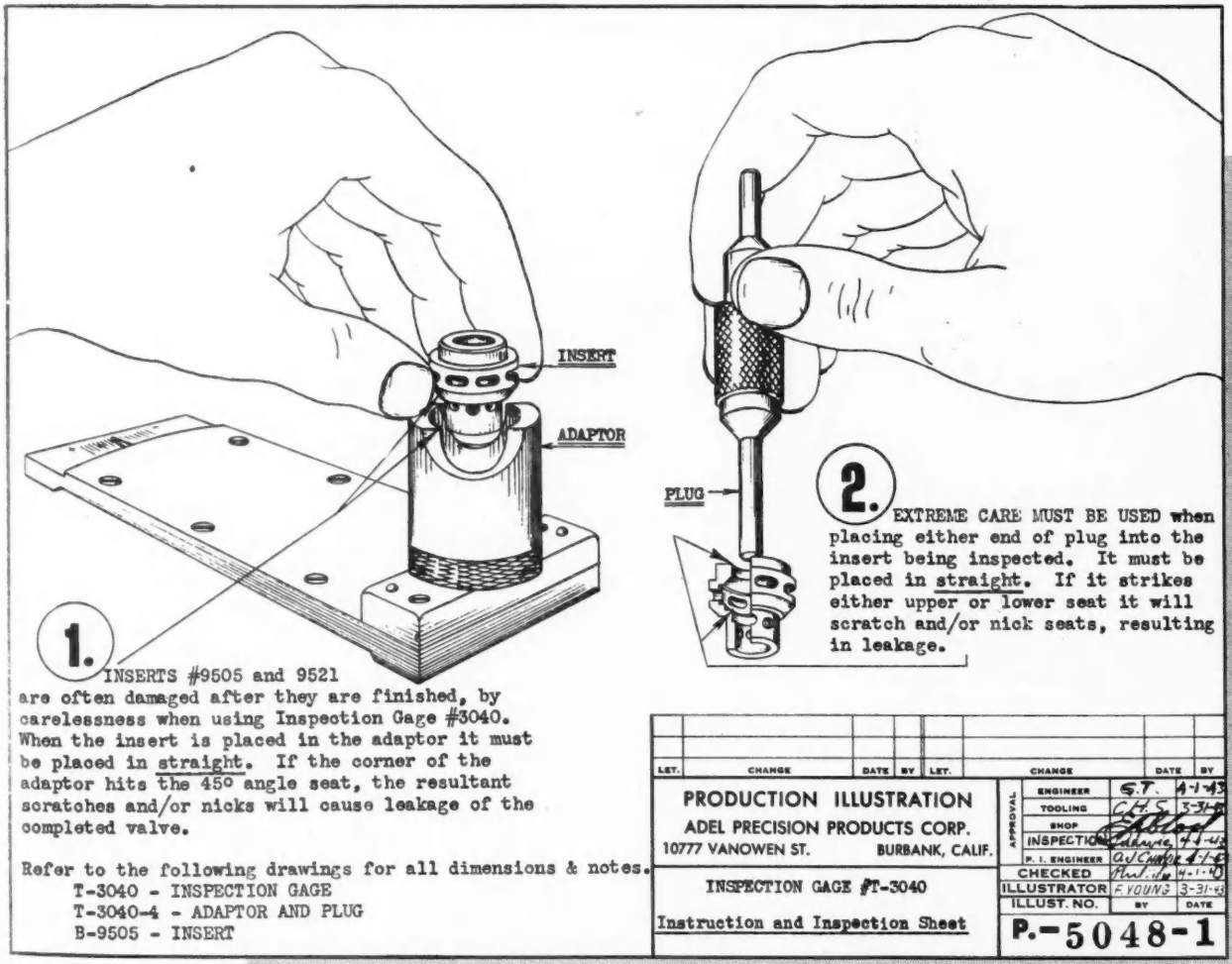

INSERT
ADAPTOR
1.
INSERTS #9505 and 9521 are often damaged after they are finished, by carelessness when using Inspection Gage #3040. When the insert is placed in the adaptor it must be placed in straight. If the corner of the adaptor hits the 45° angle seat, the resultant scratches and/or nicks will cause leakage of the completed valve.
Refer to the following drawings for all dimensions & notes.
T-3040 - INSPECTION GAGE
T-3040-4 - ADAPTOR AND PLUG
B-9505 - INSERT
PLUG
2.
EXTREME CARE MUST BE USED when placing either end of plug into the insert being inspected. It must be placed in straight. If it strikes either upper or lower seat it will scratch and/or nick seats, resulting in leakage.
LET. CHANGE DATE BY
PRODUCTION ILLUSTRATION
ADEL PRECISION PRODUCTS CORP.
10777 VANOWEN ST. BURBANK, CALIF.
INSPECTION GAGE #T-3040
Instruction and Inspection Sheet
APPROVAL
ENGINEER
TOOLING
SHOP
INSPECTION
P. I. ENGINEER
CHECKED
ILLUSTRATOR F. YOUNG 3-31-43
ILLUST. NO. BY DATE
P.-5048-1

Figure Two

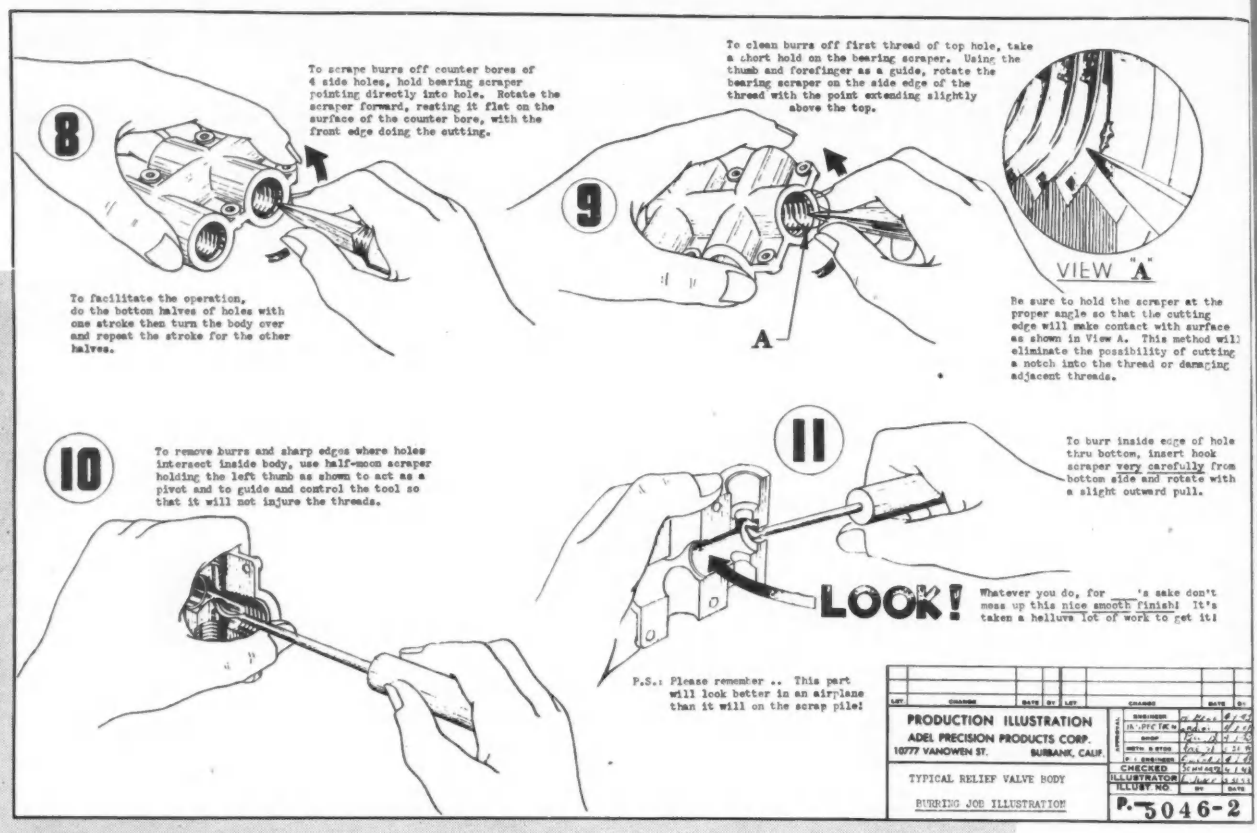

8
To scrape burrs off counter bores of 4 side holes, hold bearing scraper pointing directly into hole. Rotate the scraper forward, resting it flat on the surface of the counter bore, with the front edge doing the cutting.
To facilitate the operation, do the bottom halves of holes with one stroke then turn the body over and repeat the stroke for the other halves.
9
To clean burrs off first thread of top hole, take a short hold on the bearing scraper. Using the thumb and forefinger as a guide, rotate the bearing scraper on the side edge of the thread with the point extending slightly above the top.
A
VIEW "A"
Be sure to hold the scraper at the proper angle so that the cutting edge will make contact with surface as shown in View A. This method will eliminate the possibility of cutting a notch into the thread or damaging adjacent threads.
10
To remove burrs and sharp edges where holes intersect inside body, use half-moon scraper holding the left thumb as shown to act as a pivot and to guide and control the tool so that it will not injure the threads.
11
To burr inside edge of hole thru bottom, insert hook scraper very carefully from bottom side and rotate with a slight outward pull.
LOOK!
Whatever you do, for ____'s sake don't mess up this nice smooth finish! It's taken a helluva lot of work to get it!
P.S.: Please remember .. This part will look better in an airplane than it will on the scrap pile!
PRODUCTION ILLUSTRATION
ADEL PRECISION PRODUCTS CORP.
10777 VANOWEN ST. BURBANK, CALIF.
TYPICAL RELIEF VALVE BODY
BURRING JOB ILLUSTRATION
P.-5046-2

Figure Three

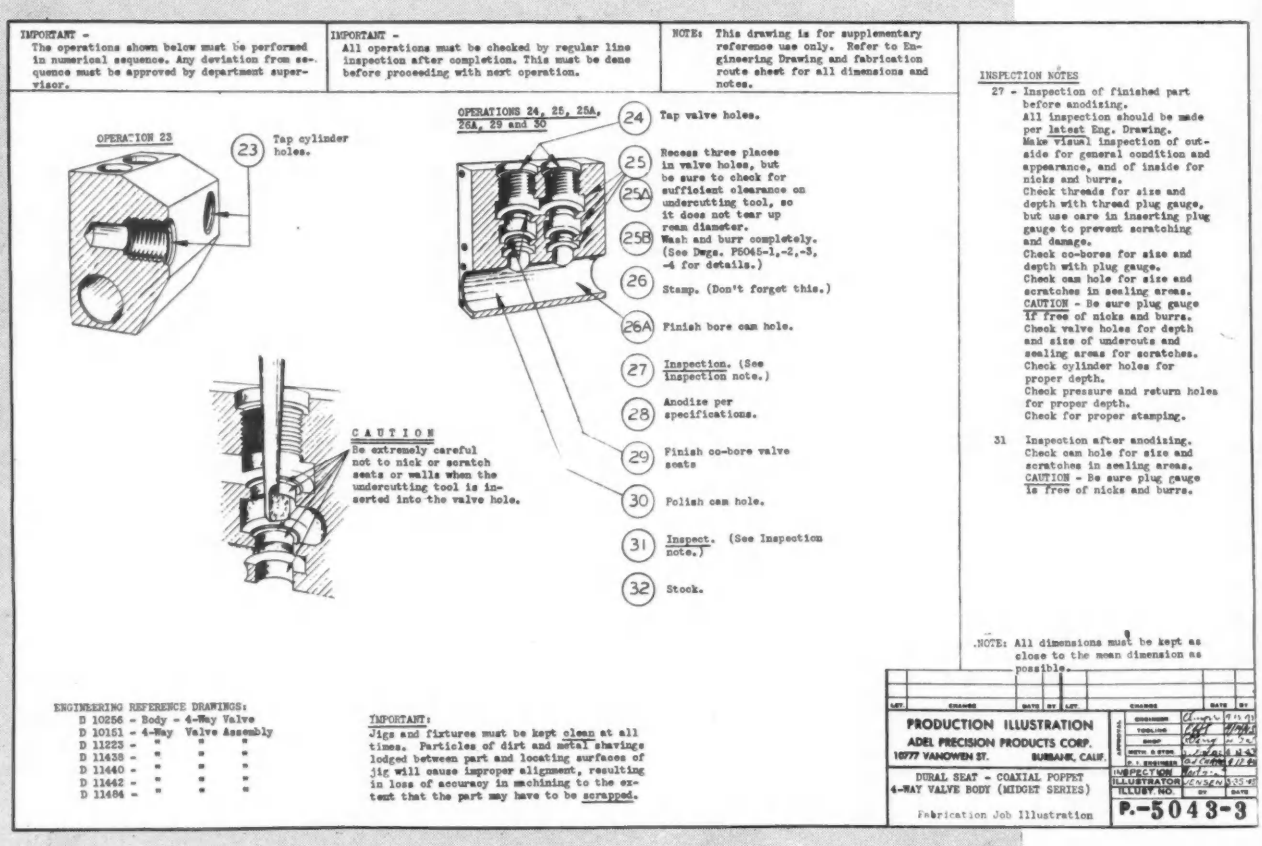

IMPORTANT - The operations shown below must be performed in numerical sequence. Any deviation from sequence must be approved by department supervisor.
IMPORTANT - All operations must be checked by regular line inspection after completion. This must be done before proceeding with next operation.
NOTE: This drawing is for supplementary reference use only. Refer to Engineering Drawing and fabrication route sheet for all dimensions and notes.
OPERATION 23
23 Tap cylinder holes.
OPERATIONS 24, 25, 25A, 25A, 29 and 30
24 Tap valve holes.
25 Recess three places in valve holes, but be sure to check for sufficient clearance on undercutting tool, so it does not tear up ream diameter.
25A Wash and burr completely. (See Dwgs. P5045-1,-2,-3, -4 for details.)
26 Stamp. (Don't forget this.)
26A Finish bore cam hole.
27 Inspection. (See inspection note.)
28 Anodize per specifications.
29 Finish co-bore valve seats
30 Polish cam hole.
31 Inspect. (See Inspection note.)
32 Stock.
CAUTION
Be extremely careful not to nick or scratch seats or walls when the undercutting tool is inserted into the valve hole.
INSPECTION NOTES
27 - Inspection of finished part before anodizing.
All inspection should be made per latest Eng. Drawing.
Make visual inspection of outside for general condition and appearance, and of inside for nicks and burrs.
Check threads for size and depth with thread plug gauge, but use care in inserting plug gauge to prevent scratching and damage.
Check co-bores for size and depth with plug gauge.
Check cam hole for size and scratches in sealing areas.
CAUTION - Be sure plug gauge is free of nicks and burrs.
Check valve holes for depth and size of undercuts and sealing areas for scratches.
Check cylinder holes for proper depth.
Check pressure and return holes for proper depth.
Check for proper stamping.
31 Inspection after anodizing.
Check cam hole for size and scratches in sealing areas.
CAUTION - Be sure plug gauge is free of nicks and burrs.
NOTE: All dimensions must be kept as close to the mean dimension as possible.
ENGINEERING REFERENCE DRAWINGS:
D 10256 - Body - 4-Way Valve
D 10151 - 4-Way Valve Assembly
D 11223 - " " "
D 11438 - " " "
D 11440 - " " "
D 11442 - " " "
D 11484 - " " "
IMPORTANT:
Jigs and fixtures must be kept clean at all times. Particles of dirt and metal shavings lodged between part and locating surfaces of jig will cause improper alignment, resulting in loss of accuracy in machining to the extent that the part may have to be scrapped.
PRODUCTION ILLUSTRATION
ADEL PRECISION PRODUCTS CORP.
10777 VANOWEN ST. BURBANK, CALIF.
DUAL SEAT - COAXIAL POPPET
4-WAY VALVE BODY (MIDGET SERIES)
Fabrication Job Illustration
P.-5043-3

Figure Four

Consideration of all factors involved resulted in the following schedule of production illustration:

Phase V—

Engineering and Tooling Illustrations.
Inspection and Instruction Sheets.
Burring and Cleaning Illustrations.
Fabrication Job Illustrations.
Assembly Job Illustrations.

Engineering and Tooling Illustrations, as new designs, are developed in the Engineering and Tooling divisions, production illustrations are made showing the progress of both phases of the project—the design of the part itself, and that of the ways and means of producing it in the factory. The part and the tools for producing it are shown in proper relationship, and the preferred methods of using the tools are indicated. These illustrations accompany the standard orthographic engineering and tooling drawings through the tool room and thence into the shop, and are useful not only in the production of tools and the parts so made, but also in the assembly, inspection, and test of the complete unit.

Inspection and Instruction sheets are illustrated for the prime purpose of explaining not only to the inspectors, but to all shop personnel concerned, the "whys" and "hows" of inspection procedure when inspecting the part under process of fabrication, the proper methods of using the inspection tools and instruments, and the sequence of inspection. Fig. 1 (P.I. drawing No. P-5048-2) illustrates the points to be covered in the inspection of two typical and similar parts. A thorough study of the illustration will show that it is supplementary to the standard engineering drawings. Note that all affected engineering and tooling drawings are listed for reference; also that all critical areas, finishes, tolerances, etc., are pointed out, with notes explaining why these restrictions are necessary. In analyzing the print it is readily seen that the illustration is not only an outline of the proper inspection procedure, but is also a definite aid in training new personnel.

The sources of information for this type of illustration are, first, the engineering drawings and drawing change orders; second, the Inspection Department; third, the Manufacturing Methods routing or procedure sheets; fourth, the Assembly and Testing Departments; fifth, the Customers' Service Department; and sixth, the common sense knowledge of the shop workers as given expression by the illustrator.

As a means of indicating the proper method of handling inspection tools, P.I. drawing P-5048-1 (Fig. 2) illustrates the use of gages in inspecting the two parts previously mentioned. Notes are added to cover the precautions necessary to prevent damage to tools or parts through improper handling methods.

Inspection Sequence drawings show the proper procedure and setup for inspecting each part, and usually

(*Turn to page* 62, *please*)

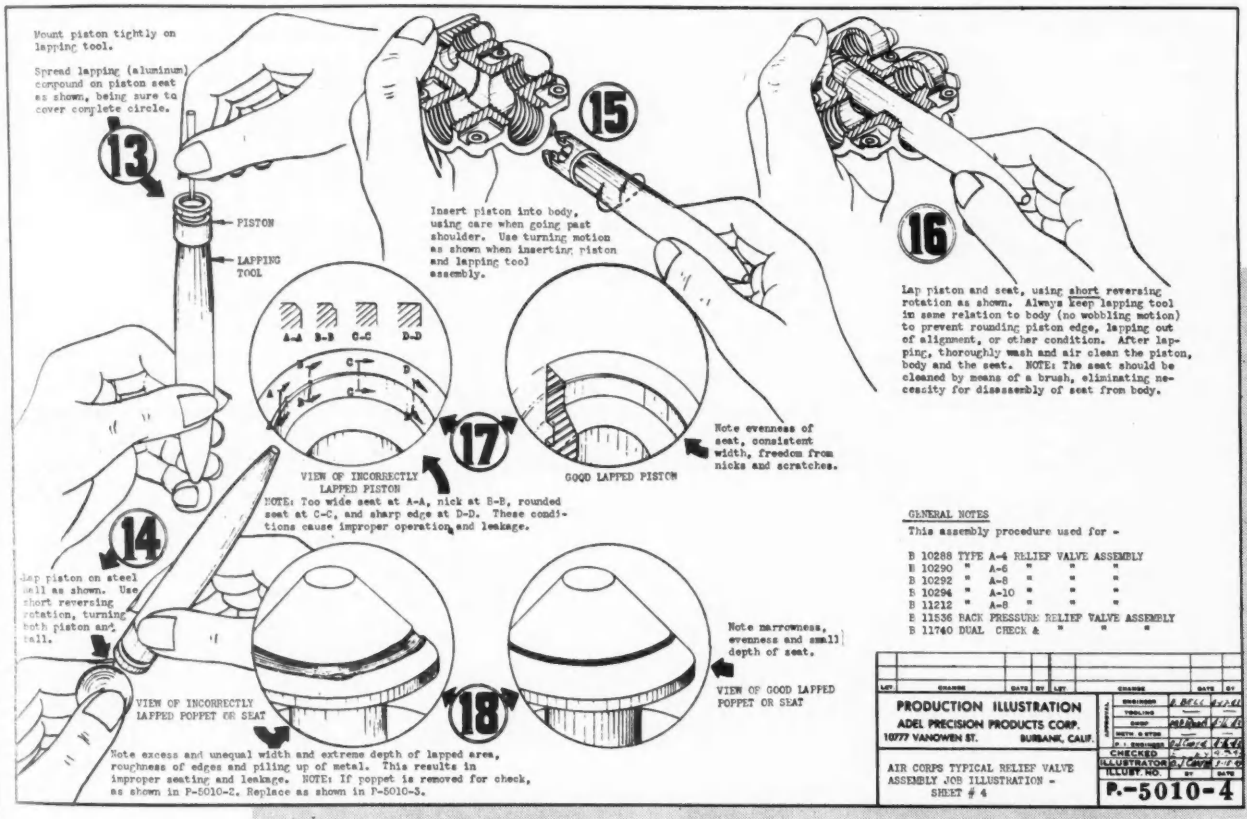
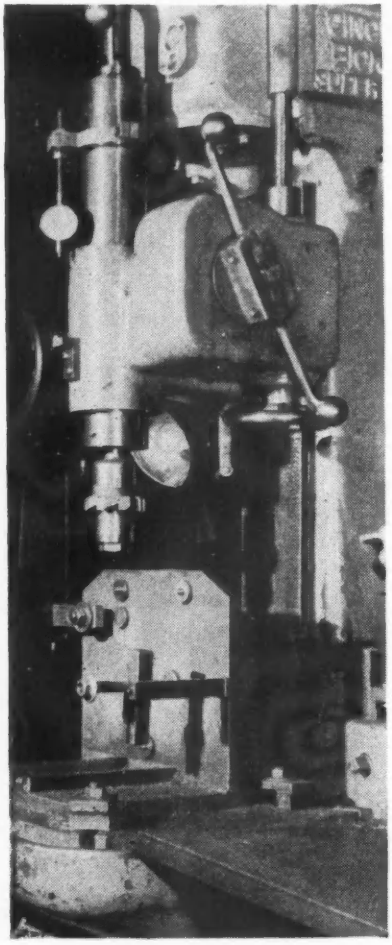

Mount piston tightly on lapping tool.
Spread lapping (aluminum) compound on piston seat as shown, being sure to cover complete circle.
13
PISTON
LAPPING TOOL
Insert piston into body, using care when going past shoulder. Use turning motion as shown when inserting piston and lapping tool assembly.
15
16
Lap piston and seat, using short reversing rotation as shown. Always keep lapping tool in same relation to body (no wobbling motion) to prevent rounding piston edge, lapping out of alignment, or other condition. After lapping, thoroughly wash and air clean the piston, body and the seat. NOTE: The seat should be cleaned by means of a brush, eliminating necessity for disassembly of seat from body.
A-A B-B C-C D-D
17
VIEW OF INCORRECTLY LAPPED PISTON
NOTE: Too wide seat at A-A, nick at B-B, rounded seat at C-C, and sharp edge at D-D. These conditions cause improper operation and leakage.
GOOD LAPPED PISTON
Note evenness of seat, consistent width, freedom from nicks and scratches.
14
Lap piston on steel ball as shown. Use short reversing rotation, turning both piston and ball.
18
VIEW OF INCORRECTLY LAPPED POPPET OR SEAT
Note excess and unequal width and extreme depth of lapped area, roughness of edges and piling up of metal. This results in improper seating and leakage. NOTE: If poppet is removed for check, as shown in P-5010-2. Replace as shown in P-5010-3.
Note narrowness, evenness and small depth of seat.
VIEW OF GOOD LAPPED POPPET OR SEAT
GENERAL NOTES
This assembly procedure used for -
B 10288 TYPE A-4 RELIEF VALVE ASSEMBLY
B 10290 " A-6 " " "
B 10292 " A-8 " " "
B 10294 " A-10 " " "
B 11212 " A-8 " " "
B 11536 BACK PRESSURE RELIEF VALVE ASSEMBLY
B 11740 DUAL CHECK & " " "
PRODUCTION ILLUSTRATION
ADEL PRECISION PRODUCTS CORP.
10777 VANOWEN ST. BURBANK, CALIF.
AIR CORPS TYPICAL RELIEF VALVE ASSEMBLY JOB ILLUSTRATION - SHEET # 4
CHECKED
ILLUSTRATOR
ILLUST. NO.
P.-5010-4

Figure Five

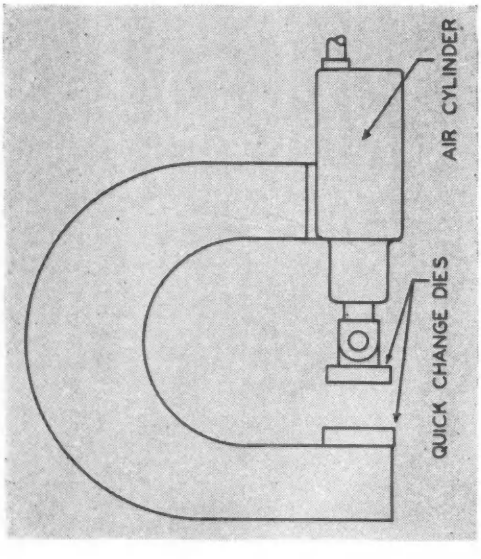
Short

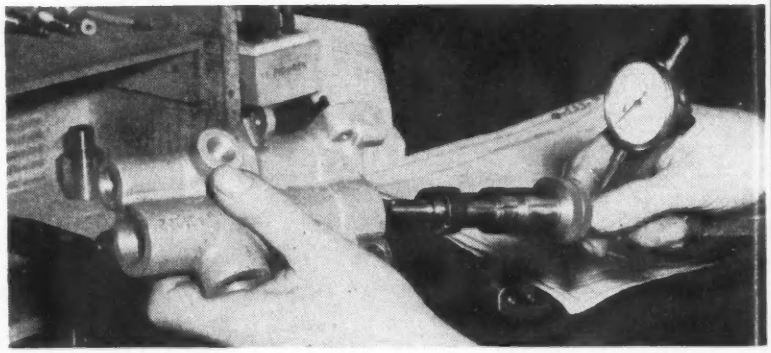


(Left) Difficulties in holding depth tolerances of plus or minus .0015 in. in facing operations with heavy duty drill presses were solved at the Springfield plant of Westinghouse Electric & Mfg. Co. by mounting a dial indicator on the spindle sleeve. A collar around the spindle sleeve holds a standard .0001 in. dial indicator by means of an adjustable threaded rod and a stop for the indicator plunger is attached to the spindle bracket. The indicator is set to read the last few thousandths of the cut and the spindle is brought down to that point by power feed. Then the feed is disengaged and the cut finished by hand feed to the proper depth as indicated by the dial.

(Above) By developing special test equipment with the cooperation of instrument and electrical manufacturers, some companies have reduced considerably the time formerly required for certain test operations. An instance is the aircraft instrument and electrical test laboratory of the Vega Aircraft Corp. that has not only made it possible to speed up production, but also to use inexperienced workers for testing. On the large panel in the photo are tested hundreds of instruments and electrical equipment for warplanes. The specially designed tester being held is for checking the accuracy of the Intervalometer, the instrument used in conjunction with the famed American bombsight. By setting its two dials, the bombardier automatically can drop a predetermined number of bombs on a target at any desired spacing along the ground, regardless of the plane's speed or altitude.

(Below) A device employed in removing wrinkles from sheet stock after press work has been devised by Walter M. Kugel of Bell Aircraft Corp. It consists of a support, an air cylinder, and quick-change dies. The same device may be used to increase the section of metal by first forming wrinkles by means of a wrinkling tool and then pressing them out, which will result in a local increase in section.





(Above) By the use of this specially-designed gage the inspection department of Bendix Aviation, Ltd., of California eliminated expensive tear downs which formerly were necessary if assembled units proved faulty. The rate of production was increased from 75 to 100 units per day. The gage is used to check the concentricity of two internal surfaces 4 in. deep, in an hydraulic uplock. Formerly plug gages were used for that purpose.

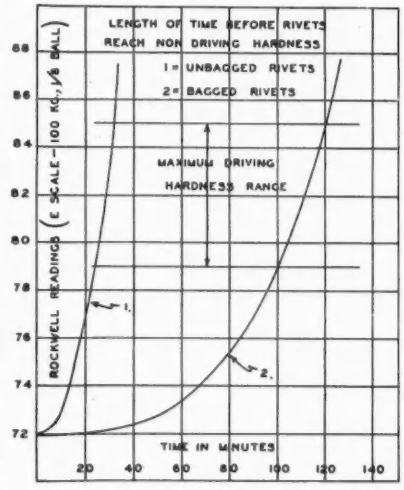
Cuts

Results of a typical test showing use of bagged and un-bagged rivets.

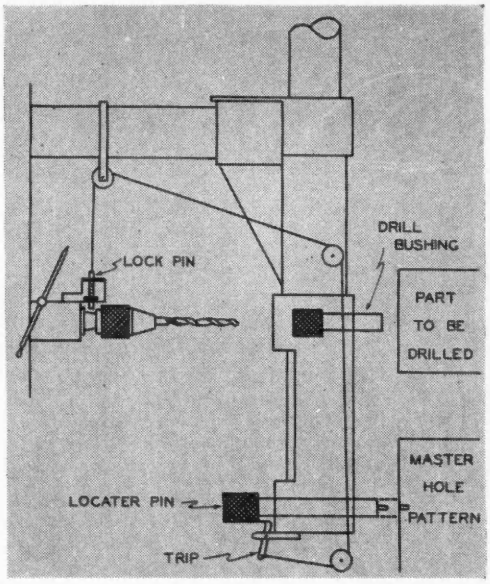
NONHEAT-TREATED RIVETS

UN-BAGGED RIVETS		
Weight of rivets in surfaces (useful rivets)	48.5	lbs.
Weight of rivets from sweepings	16.5	lbs.
Weight of mixed rivets returned from benches	17.4	lbs.
Total rivet demand during period of test	82.4	lbs.
Weight of rivets lost through damage	.75	lbs.
Time required to sort items 2 and 3	40.6	hrs.
Cost to screen	$3.00	
Cost to sort	30.42	
Cost of damaged rivets @ $1.00 per lb.	$0.75	
Cost of reclamation and damages per pound of useful rivets	$0.709	
BAGGED RIVETS		
Weight of bagged rivets used	42.8	lbs.
Weight of bagged rivets returned	1.35	lbs.
Weight of bagged rivets to be sorted	.094	lbs.
Weight of useful rivets	41.45	lbs.
Time required to bag and seal	1.8	hrs.
Cost to bag and seal	$2.70	
Cost to sort bagged rivets	$0.084	
Cost of bagging and sorting per pound of useful rivets	$0.0672	

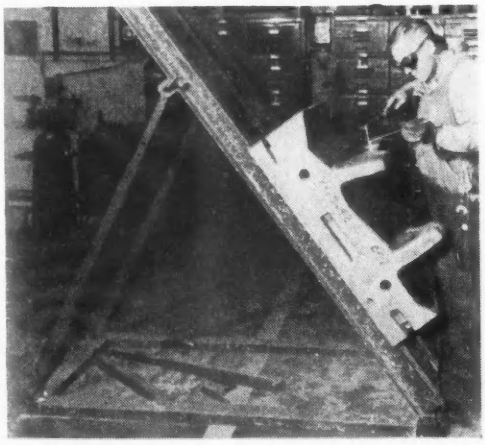
Cost of unbagged rivets ($.709) compared to cost of bagged rivets ($.0672) shows saving of 10 to 1 in favor of bagged rivets (non-heat treated). With heat treat rivets saving is 4 to 1.



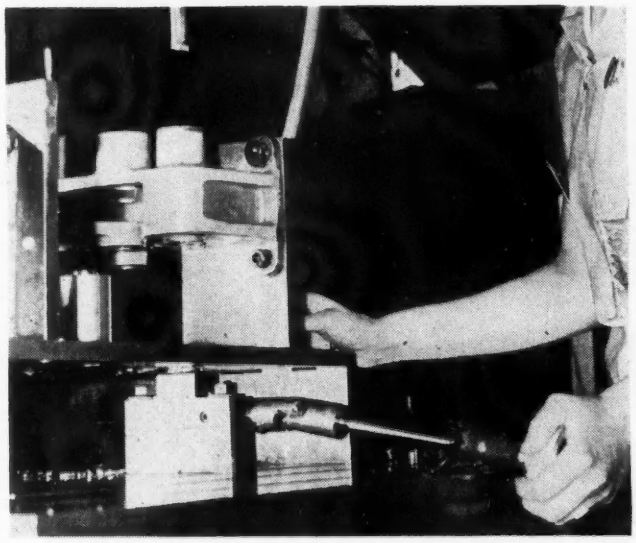
(Above) Fleetwings has found that by packing aluminum alloy rivets in cellophane bags workers drop only a negligible number on the floor as compared to the large number that fall there when they are obtained from racks. The cost saving is shown in the accompanying table. About two ounces of rivets are placed in each bag, which has been indelibly marked, and then it is crimped and sealed with heat. Heat treated rivets in the bags do not harden as quickly as when they are held loosely in the hands. The bagged rivets stay "soft" enough two hours for driving, as shown by the chart.



(Above) This automatic pin-lock device, which was developed at the Long Island plant of the Brewster Aeronautical Corp. for use on main beam assembly drill jigs, assures correctly drilled holes in the beam and makes it possible for the shop to put helpers on this job, where it formerly required "C" mechanics to operate the jigs. With the locater pin in position in one of the holes of the master pattern, the head of the pin pulls the trip lever forward, and with it the wire stretched over the pulleys attached to the lock pin, thereby raising the pin clear of the drill chuck, permitting drilling operations. With the locater pin out of position, the trip lever is free and the lock pin then falls into its lock-position behind the chuck sleeve, automatically locking use of the drill.



(Left) Kirksite dies often have indentations or holes formed in them when the molten metal cools. In refacing the dies by welding, it is necessary that the surface worked on should be horizontal. The device here shown, due to B. W. Vinsonhaler of Douglas Aircraft Company's Long Beach plant, permits of moving the die secured to it into such a position that any given surface on the die will be horizontal. The device is raised and lowered by means of an overhead crane, the chain of which hooks into rings or eyes at the top of the leveling device.



(Right) Jig-boring precisely located gear centers is simplified by this locating-pin fixture developed by General Electric engineers. The fixture consists of a cubical steel block into which is built a small rack and pinion gear actuating a ½-in. dia. locating pin made to a sliding fit. The pin is raised or lowered by means of a universal shaft. The fixture is permanently locked to the machine table so that the locating pin is exactly positioned with respect to the center of rotation of the spindle. The work is clamped to a master boring plate containing ½-in. dia. holes. Then, locating and clamping the master plate in accordance with the locating pin is all the operator needs to do to bore the required gear centers with absolute precision.

Impression-Cast Jaws f

Fig. 1—Stages in mass production of cast jaws.

Fig. 2—Prepared forging and cast slug.

Fig. 3—Machining the forging.

Fig. 4—Preheating the molds.

Fig. 5—Pouring molten Kirksite A into preheated molds.

Fig. 6—Two wide slots are milled for adaptation to two-jawed air chucks.

Fig. 7—Drilling mounting hobs.

CAST metal jaws to hold parts for machining operations have been used at sometime or other by most shops. Usually they are made of brass, bronze or cast iron and in most cases a certain amount of cavity finishing with highly skilled labor is necessary to make them usable. The users of jaws cast in lead, babbit or fusible alloy have found them limited for high production because of the lack of durability.

The American Screw Products in the manufacture of hydraulic fittings over a long period of time fol-

for Aircraft Fittings

lowed the common practice of machining the jaws out of steel. The procedure was naturally slow, expensive and efficient only with skilled labor. In an effort to comply with the War Production Board's request for greater production, experiments were made with a commercial type of fusible alloy cast around the forging and subsequently separated into two parts or jaws. The need of harder and more durable material led to the development of jaws cast from a zinc-base alloy know as Kirksite A.

By H. F. Lenz
Chief Engineer
American Screw Products

The system of making these jaws on a production basis has revolutionized the machining of forgings in this plant. Believing that a tremendous number of man-hours can be saved by its introduction into other plants, the management of the American Screw Products is making public the procedure so that more machined parts can be produced to meet the demand of the war effort. To further this purpose, engineering service and data are freely offered to those interested.

The particular value of the system (developed by close co-operation between the Engineering Department, Rudy Rosenow, Superintendent, and his assistants, George Erkelens and Joe Durgin) is in its universal adaptation to the various types of clamping fixtures, chucks, oversized collets and vises. The completed jaws as shown in Fig. 1 permit their use in multiple-spindle automatic chucking machines, wire-feed screw machines, turret lathes and vises.

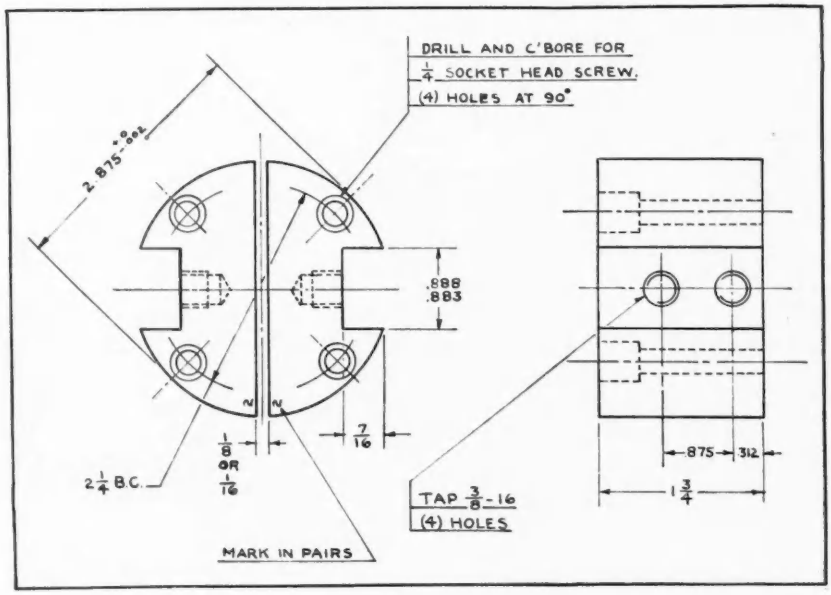
Two sizes of jaws (2⅞ in. and 4 in. outside diameters) accommodate practically all of the forgings processed. Made in sets of five pairs they can be used on the automatic chucking machines for long runs. If a short run is needed, any set can be mounted on the two-jawed air-chucks, the Barker wrenchless chucks or the special oversized collets of American Screw Products design. If a drill press operation is needed the jaws are mounted in an air-operated vise as shown in the accompanying illustration. The so-called "beginners" class of labor can be used on all operations and a pair of jaws can be completed in 50 min. With division of labor a set of five pairs of jaws can be made in approximately three hours.

Referring to Fig. 3 attention is called to the first operation performed on the forging. One end of the forging is faced and turned to a fixed dimension (Fig. 2) to fit the particular bushing inserted in the adapter of the mold. A line is also inscribed on the face and parallel to the other leg of the forging to direct the separation of the casting into halves. The forging is sprayed with graphitic separator and pushed into the hole in the adapter.

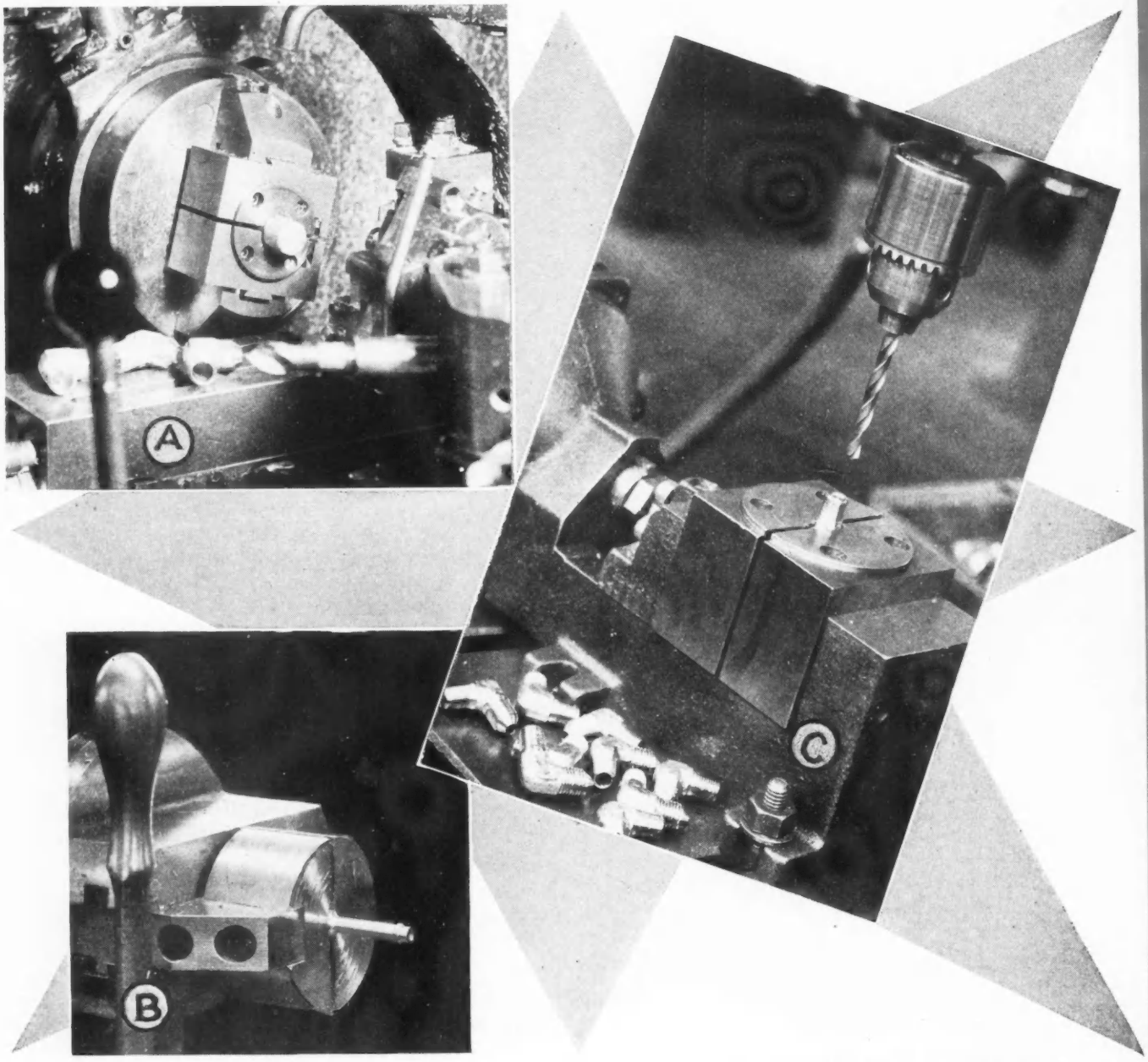
The haves of the mold (Fig. 2 and detailed drawing) are now placed around the adapter, the cap is put in place and the whole secured with the metal clamp. A specially built burner permits five of the molds to be placed in a row for pre-heating and casting (Fig. 4 and 5). The pouring temperature of 820 deg. F is controlled by a pyrometer. As soon as the Kirksite has chilled, the cast slug is removed.

The turned portion of the forging protruding from the slug (Fig. 2) is now clamped in a true-running collet, the outside diameter of the slug (see detailed drawing) is finished with one cut and the end is squared. The casting is then reversed in a three-jawed chuck and faced to length. Four holes (in relation to the line scribed on the end of the forging) are then drilled in the jig shown in Fig. 1 and counterbored for ¼ in. socket head screws for adaptation to oversized collets. Two ⅞ in. wide slots milled at 180 deg to a depth of 7/16 in. are added (Fig. 6) for adaptation to two-jawed airchucks. Two holes for ⅜ screws (Fig. 7) are then tapped in each slot for mounting in the two-jawed chucks or special false jaws.

The slug then goes on to the milling machine fixture



Details of impression-cast jaws.



A—Jaws mounted in a New Britain 4 spindle automatic chucking machine.

B—Application of jaws to a Barker wrenchless chuck.

C—Drilling operation with Kirksite A jaws.

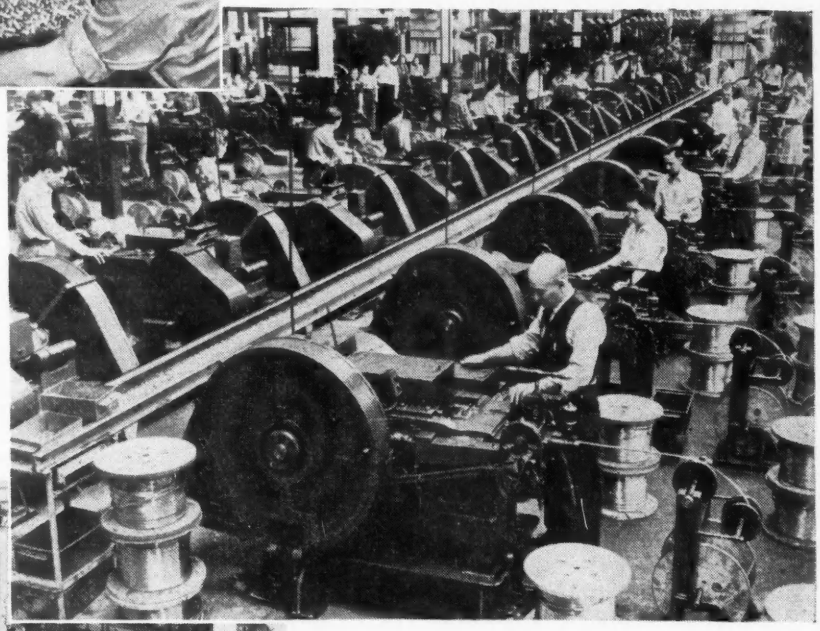
(Fig. 6) where it is located by stops inserted in the slots and a ⅛ in. or 1/16 in. saw is passed through separating it into halves. The split parts of the forging (Fig. 1) are knocked out, the halves are suitably marked and after being taped together are sent to the tool crib in the special wood containers shown.

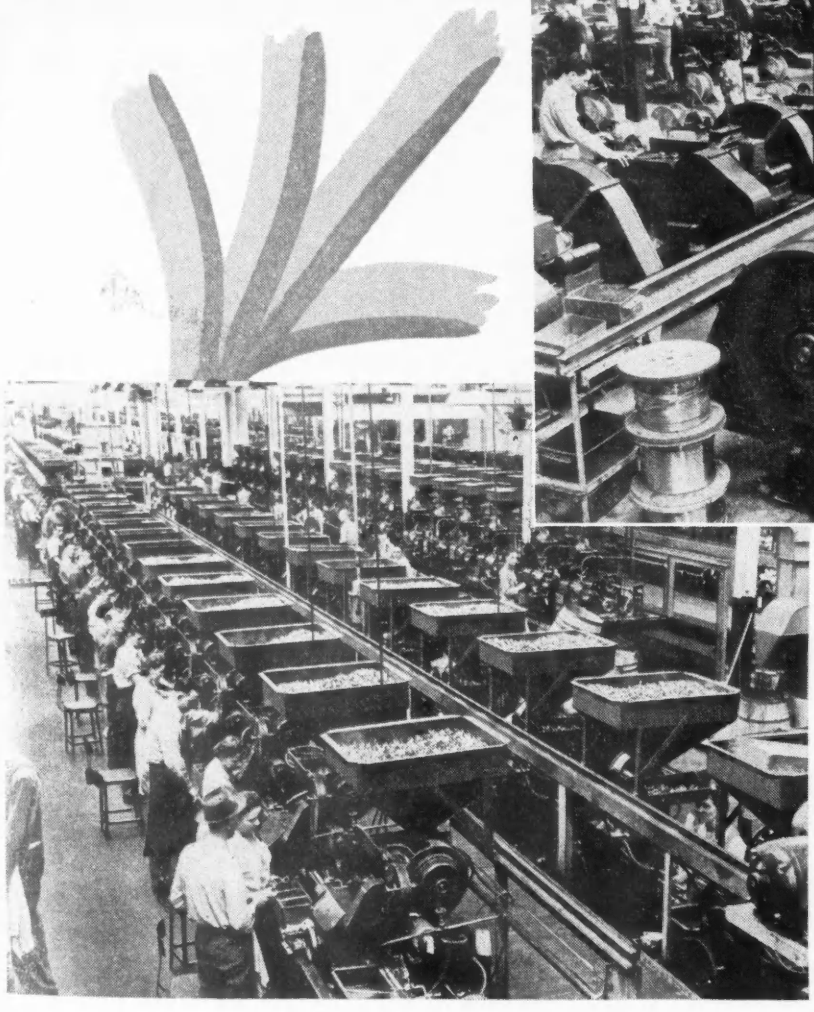
The American Screw Products has found that operators and set-up men prefer this type of jaw to the old machined kind. Since they require no shimming or adjusting and with the forging rigidly held due to the large area of contact, they produce superior work. With the best tool-making skill the conventional steel jaws can rarely be set up ready to go without losing valuable productive time. The jaws made in the described manner can be mounted very quickly and the forging will run true. This makes possible an allowance of only 1/16 in. on the diameter for turning instead of the not uncommon allowance of 3/32 in. or ⅛ in. A set of Kirksite jaws is good for 8000 to 10,000 operations without loss of accuracy. Rapid and economical jaw replacement makes this process a marked advance in shop practice.

The American Screw Products is now experimenting with a design of mold which will cast the jaws completely cored, slotted and sized so that splitting into halves will be about the only operation necessary to prepare the jaws for use. As soon as the design has been perfected, the information will be given to the trade.

Chrysler
Ammunition
Arsenal

(Left) Formerly an assembly plant for Plymouth passenger cars and Dodge trucks, the Evansville, Ind., plant of the Chrysler Corp. was converted early in 1942 to an ammunition arsenal and since then has been turning out .45 cal cartridges in large quantities. In February of this year .30 cal carbine ammunition was added to production. Over 12,000 workers, about 60 per cent women, make millions of rounds of ammunition daily. In peacetime the plant employed 650 workers. The plant has over 1000 inspectors, who in conjunction with hundreds of automatic gaging machines, put each cartridge, during its 46 different manufacturing stages, through 334 inspections. In the photo is shown (left) steel cartridge cases coming from one of the many heat treating ovens.



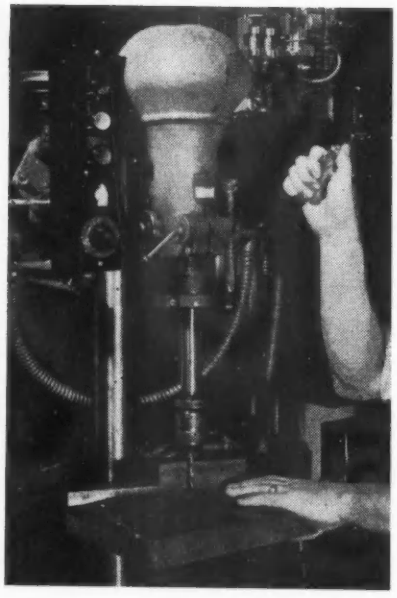


(Above) Slugs are cut from spools of lead wire at the Evansville Ordnance plant and then are carried on endless belts to automatic machines which shape them and cover them with copper plated jackets.

(Left) Long batteries of automatic machines speed the forming operations on the steel cartridge cases. Finished cartridges are held to 0.001 in. tolerance.

New Production Equipment

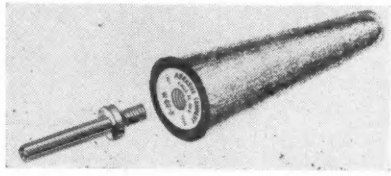
THE application of a 1/3-hp Thy-mo-trol drive to a small drill press at General Electric's Schenectady, Pa. plant has greatly increased the drill's field of usefulness. A range of operating speeds from 25 rpm to 1750 rpm, obtained by turning a small knob on a push-button station, enables this simple drill press to do jobs that would otherwise require a much more complicated machine or machines.



Thy-mo-trol equipped drill press

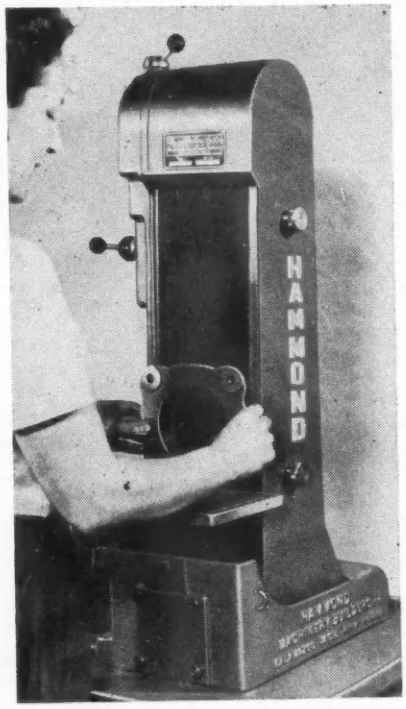
Speeds available on this Thy-mo-trol equipped drill are so much slower than those obtainable without changing pulleys on similar drills, that it can be used on hard-to-drill materials, such as molded compounds, and for the fly cutting of large diameter disks. Since the drive permits reversing as well as independent adjustment of speed in each direction, tapping can be done at the proper preselected speeds for both tap and back-out.

A NEW line of Abrasive mounted wheels and mounted points, named Victory Points with demountable spindles, has just been introduced by Abrasive Company, Philadelphia, Pa. Victory Points consist of a threaded bushing inserted in and fused to the abrasive wheel mass during the vitrifaction process. The demountable spindle screws into the porcelain bushing and forms a tight fit, so that the spindle cannot break off, pull out, twist or turn. Points are replaced by unscrewing from the spindle, which need not be removed from the grinder chuck or head. Victory Points are made in standard grain and grade combinations in vitrified bonded wheels or points. Demountable spindle size is limited to ¼ in. diameter by 1¼ in. length.



Victory Point with demountable spindle

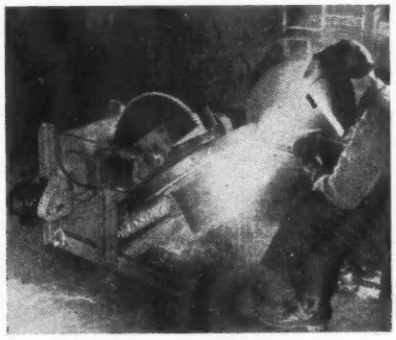
A NEW 6 in. Wet-N-Dri Abrasive Belt Grinder is now in production at Hammond Machinery Builders, Kalamazoo, Mich. The new pulley-motor mountings are adjustable from outside the base, and the machine can be adjusted from vertical to horizontal position while running. The belt tension and tracking device also can be adjusted while the machine is running. The cast iron abrasive belt pulleys are dynamically balanced, and run on dust-proof ball bearings.



The Hammond "600" Wet-N-Dri Abrasive Belt Grinder

The Hammond "600" Wet-N-Dri machine illustrated provides wet operation for grinding, polishing or surfacing. It is equipped with tank and pump unit, and can be equipped for water main connections only. The machine may be operated dry, if desired. For dry operation, the water is turned off, the drain connection is removed, and an air exhaust system attached in place of the drain connection. The "600" Dri machine is arranged for an individual dust collector or for connection to an exhaust system.

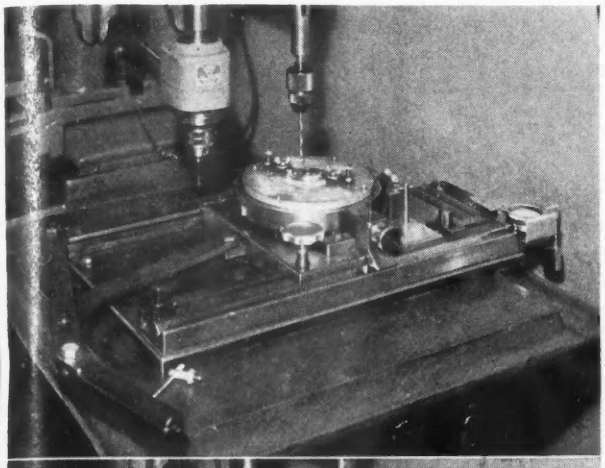
THE 500 lb capacity Welding Positioner announced by the Ransome Machinery Company, Dunellen, N. J., is designed to handle maximum loads with a center of gravity of load 6 in. away from the table top, and with an eccentricity of 6 in. The Positioners are available in hand or motor operated models, and are said to be particularly suited to work ordinarily handled by women welders. The motorized unit includes a Reeves variable speed drive which provides a speed range up to 1 rpm of the table top. Tilting range is 135 deg from horizontal, or 45 deg beyond vertical, providing the "down under" position for all downhand welds.

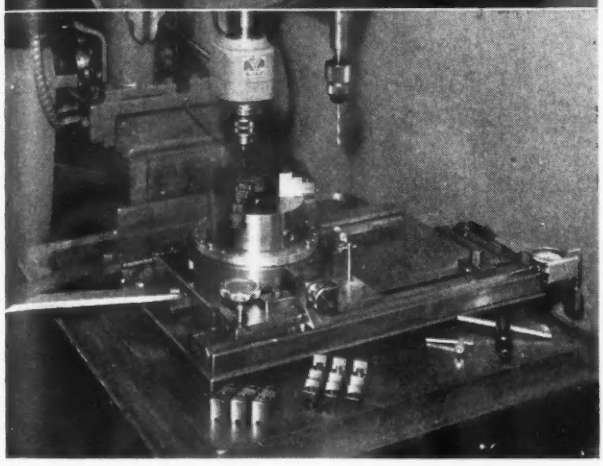


Ransome 500 lb. Welding Positioner

All gears are of the cut-tooth type. The machine can be furnished with a regular base for bench work, or with a sub-base which provides a height adjustment of 27 in. to 42 in. from the floor line to the table top. A clutch arrangement permits free rotation of the 26 in. circular table top. Motorized

(*Turn to page 72, please*)





Drill Press Fixture for Replacing Jigs and Templates

(Top) The complete fixture on a drill press.

(Below) A universal chuck mounted on the index head of the fixture.

By C. W. Fuller

Schenectady Works, General Electric Co.

THIS fixture is a convenient means for accurately locating, drilling, and tapping holes spaced radially about the center of a gear, gear hub, or similar pieces, and is especially efficient for performing two operations in sequence such as drilling and tapping, countersinking or counterboring. The specially slotted plate adapted to the top of the index permits drilling and tapping holes in rectangular pieces at the specified angular relation to each other. Originally the purpose was to construct it for use on short, odd or supply jobs, thus saving the cost of approximately 2000 simple jigs and templates per year.

The fixture is mounted upon a bed plate which has been suitably doweled to the table of the drill press. The center plug or the main center of the index head, which is mounted on a carriage equipped with a manually-operated lever for sliding it in the ways of the bed plate, is positioned and indicated to a drill spindle. The index head is graduated in degrees and provided with a number of locating notches for equally spacing a group of holes about a center. These notches are engaged by a spring plunger assembled to the slide, which permits lateral movement only in relation to normal working position at the machine. When it is undesirable to use these notches, they may be covered by suitable inserts.

Accurate adjustment of the lateral position of the index under either spindle is obtained through the use of size blocks and an indicator mounted on either or both ends similar to the manner employed when moving from one hole to another on the jig-boring machine. In other words, the center distance between spindles is known and the distance between holes on the piece is shown or can be readily computed. Therefore, to move the index head or plate holding the work to the correct position for the next hole, the corresponding length of gage blocks are removed for that type of job, the fixture is moved, and the adjustable stops are tightened.

If it is desired to move the work directly beneath the second spindle for the next operation, a pin or dowel is removed from a hole extending through the sliding carriage plate and the bed plate. The index head is then moved a distance corresponding to that between spindle and the pin inserted, thus accurately locating the previously drilled hole beneath the second spindle for the next operation. The adjustable stops can also be used when transferring to or duplicating a given location.

As shown in the accompanying illustration, a universal chuck with three sets of chuck jaws for various sizes of work is mounted on the index head for centering and holding circular work. When it is desired to locate and drill a hole somewhere between the previously referred notches, the angle graduations on the index head are used. The head is revolved to a reference line on the spring-plunger assembly and tightened by means of a hand nut located at the right-hand end of the fixture. In conjunction with this fixture, automatic drill chucks are used, enabling drills to be changed without stopping the machine. Best results from the use of this drill fixture are obtained by an operator thoroughly familiar with the device and its purpose.

Important Technical Topics Discussed at SAE *Meetings*

IN SAE circles the month of June, 1943, was highlighted by two important events—the meeting in Cleveland, sponsored by Cleveland Section, the SAE Diesel Engine Activity, and SAE Fuels and Lubricants Activity, and the meeting in Detroit, sponsored by Detroit Section, SAE Passenger Car Activity, Production Activity, Truck and Bus Activity. These two-day meetings were well attended and, in the opinion of those participating, constituted the most successful Summer meetings in many years.

Banner event of the Detroit meeting was an afternoon spent with C. F. Kettering, whose spirited talk served to brush away many mental cobwebs. Commenting on current discussion of the "Car of the Future," Kettering gave as his opinion that the car to be built immediately after the war would be the same, substantially, as the 1942 model. "The wishful thinking of columnists and industrial designers cannot alter the realistic picture," said Boss Ket, "Since the motor car producers have neither the time nor the men nor the materials with which to develop anything different or radical until the war is over."

Perhaps the greatest contribution of the Cleveland meeting was contained in several papers posing problems of industry-wide importance. Let us touch briefly on some of the pertinent recommendations.

Captain Lisle F. Small, representing the shipbuilding division, Bureau of Ships, U. S. Navy, the banquet speaker on this occasion, marked World War II as a Diesel war so far as the Navy is concerned. He pointed out that in contrast with World War I when the Navy had about 150,000 Diesel horsepower in service, today it boasts between 12 million and 13 million Diesel horsepower. Most effective application of Diesel power in the Navy is the adoption of "multi-Diesel engine, indirect drive" in which any desired number of engines can be coupled to a single driveshaft through combinations of electric generators and reduction gearing.

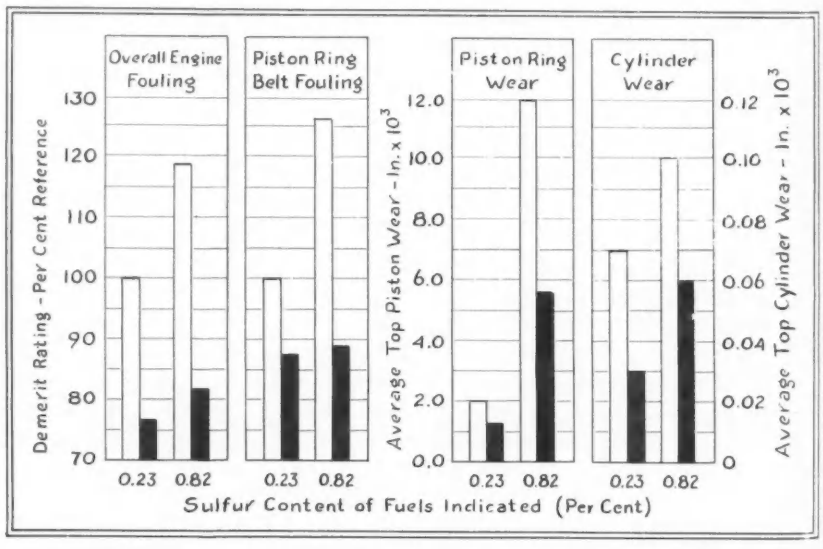
Captain Small asked for an immediate attack on a number of vital problems. Foremost of these is the matter of torsional vibration which, he said, is a serious shortcoming in certain makes and types of engines. Another vital problem is one of reducing the waste of critical materials in the forging process. Attention was drawn to the need for attacking the shortages in heavy forging capacity, and in the currently overloaded condition of engine bearing plants which has resulted in a falling off of deliveries of spare parts. Captain Small also asked for assistance in hurrying the development of the gasoline turbine. He intimated that the Navy is working along lines that promise a practical approach to the problem.

From the standpoint of general interest, the paper by J. C. Fetters, Electro-Motive Division, GMC, describing the so-called "pancake" engine, was of outstanding merit. This paper appeared in AUTOMOTIVE AND AVIATION INDUSTRIES, June 15, 1943.

Two papers on Diesel fuels warned of a grave situation which deserves immediate action on the part of the industry and the military services. C. M. Larson, chief consulting engineer, Sinclair Refining Co., in his paper "Octanes or Cetanes After World War II" prophesied that the increasing demand for 100-octane aviation gasoline is bound to penalize the high speed Diesel engine by reducing the amount of fuel available and worse still, by causing a depreciation in cetane value down to around 40 to 45. This is attributed to the expansion of new catalytic cracking plants which are capable of converting the major part of the crude to high octane gasoline.

G. H. Cloud and A. J. Blackwood, Esso Laboratories, in their paper "The Influence of Diesel Fuel Properties on Engine Deposits and Wear" showed that the fouling of Diesel engines is influenced by sulfur, by low ignition quality, and by viscosity. Sulfur is easily the worst offender. Using a reference fuel containing about 0.23 per cent sulfur, the authors showed that increases in sulfur content above this value produced sludging, ring sticking, and abnormal wear (see illustration).

For a picture of the commercial fuel situation, we refer you to the Diesel fuel specifications published in *Commercial Car Journal*, April, 1943. This



Effect of lubricant on engine fouling and wear. Black bars represent compounded lubricant, white bars represent uncompounded lubricant.

By Joseph Geschelin

in Cleveland *and* Detroit

tabulation, an exclusive feature of *Commercial Car Journal*, provides pertinent data on the properties of all fuels marketed in the U. S. The conclusions drawn from the work of Cloud and Blackwood may be summarized as follows:

"Considering all phases of these studies, it is clear that the selection of suitable fuels is an important factor in the control of fouling and wear of automotive Diesel engines. Assuming stability, freedom from water and soaps and absence of corrosive, abrasive and residual materials, the major Diesel fuel characteristics governing automotive Diesel engine fouling and wear are sulfur content, ignition quality and viscosity and/or volatility."

"The influence of these fuel properties as determined in this work, particularly the influence of sulfur on fouling and wear, apparently cannot be applied directly to larger slow speed Diesels in marine or industrial service. A 12-month test on two 13 by 18 in. Diesel engines in marine service—the starboard engine on one fuel and the port engine on the other—failed to show unusual fouling or wear on high sulfur fuel compared to low sulfur fuel."

Many pertinent observations concerning the behavior and shortcomings of commercial engines in combat service were described by Lt. Colonel Carl E. Cummings, Tank-Automotive Center. Combat experience has proved that military operations impose service conditions far more severe than any commercial practice. This has been reflected in the many mechanical changes introduced by engine builders during the past two years. Combat service has proved that failures in the field, in the majority of cases, have been due to minor mechanical details. But the weakest link is said to be the item of engine accessories. Evidently, commercial accessories have not been equal to the strain of combat operations.

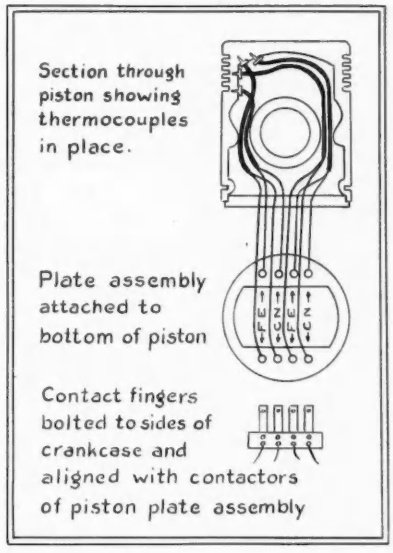
Col. Cummings emphasized the need for light-weight engines, pointing out that power to weight ratio of currently used engines varies from a low of 5.5 to as high as 15 pounds per b.hp. He feels that fuel economy has not been given the attention it deserves.

Due to the nature of the supply problem and the need for utilizing fuels wherever they are available Col. Cummings asked for de-emphasis upon quality fuels and asked that attention be given to the most efficient utilization of lower grade fuels. As a suggestion, he recommended study of the adoption of solid injection for gasoline engines; and the development of Diesel injection systems capable of utilizing either Diesel fuel or gasoline.

In this connection, Glenn Shoemaker, chief engineer, Detroit Diesel Div., GMC, and several others mentioned that some experimental work along these lines has shown that the high speed Diesel engine can be made to run on gasoline with advantage in fuel economy over a gasoline engine.

"Lubricants for Ordnance Combat and Motor Transport Vehicles," a paper by Major R. E. Jeffrey, Ordnance Dept., described the program of standardization and simplification of types of lubricants currently in effect. In addition, the author outlined the procedure for qualifying lubricating oils under new specifications developed by the Army. Light was shed on the technique of engine silencing by Ralph L. Leadbetter, Burgess Battery Co., in his paper, "Control and Suppression of Diesel Engine Noise." The paper describes the development of air silencers and exhaust snubbers, with appropriate comment on the investigational techniques based on modern theory and practice.

Two papers dealt with research methods of correlating engine tests with service performance in rating lubricants for Diesel engines. "The Fairbanks-Morse Diesel Engine as a Research Tool for Pre-Evaluation of Heavy Duty Motor Oils," by Moir, Hackoff, and Williams of The Pure Oil Co., indicated one line of approach using the Fairbanks-Morse engine as a laboratory machine. Various setups were investigated for measuring piston temperatures and the system finally adopted is shown in the accompanying illustration. The paper by R. S. Wetmiller and Bruce Hegeman, The Texas Co., "Comparison of Laboratory Diesel Engine Tests with Service Performance" outlined another form of experimental procedure using the General Motors Model 71 Diesel engine as the test machine. In each instance, the authors offer proof that the test method gives satisfactory correlation with actual service performance.

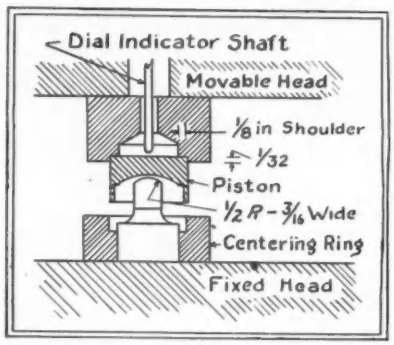

Section through piston showing thermocouples in place.
Plate assembly attached to bottom of piston
Contact fingers bolted to sides of crankcase and aligned with contactors of piston plate assembly

Ring temperature measuring set-up

The Detroit meeting continued with discussions of military problems and the effect of combat service on commercial automotive equipment. It was obvious that the commercial equipment available to the military services, although admittedly the best in the world and admirably suited to civilian needs, requires further development and alteration if specialized military requirements are to be adequately met. This is simply and plainly a situation brought about by the lessons of a new war.

Col. E. S. Van Duesen, in his paper "Lessons Learned from World War II about Designing for Accessibility," indicated that the modern handsomely streamlined motor truck was not as well suited to the needs of the Army as was the standard Class B truck of World War I. The gadgetry and special equipment designed for comfort and ease of operation under peacetime operating conditions all tend to intensify the problems of maintenance in the field. From that standpoint the modern heavy duty vehicles leave much to be desired in accessibility, according to Col. Van Duesen.

"Special tools are the bane of military automotive maintenance," continued the speaker. "Any unit which requires the use of tools in the removal



Wheel brake cylinder piston, Tinius Olsen compression test fixture

of covers or interfering parts, in order to make it accessible for adjustment or servicing cannot be considered as accessible."

When it comes to combat vehicles such as tanks, accessibility must be sacrificed to the military requirements, Col. Van Duesen stated. Even here, latest developments have provided hinged instead of bolted inspection covers, quickly detachable electrical, fuel, and other connections, and the relocation of lubrication fittings. Another major step forward is the adoption of design features which permit the ready unit replacement of certain components which may be extended to the powerplant itself.

For the first time since the onset of the War, the Ordnance Department presented its picture of the idealized engine for tank service. This was contained in an excellent paper "Engines for Tanks," by Lt. Col. R. J. Icks, of T-A-C. To summarize the specifications of the ideal engine, Col. Icks presented the following generalized requirements:

a. 650 gross horsepower.
b. Horizontal or V-type.
c. Air-cooled.
d. Injection system capable of handling Diesel fuel, gasoline or other available fuels.

The Special Engine Committee recommends that: Two gasoline engines be developed; one a 450 net brake horsepower at a governed speed of 2500 rpm, and the other a 650 gross brake horsepower at the same speed. Both of these are to be carburetor engines. They further recommended that two Diesel engines of the same horsepower and speed be developed. Injectors should successfully use gasoline of 80 octane rating or less, but with a lower horsepower for the same rack setting as for Diesel fuel.

The engines are to be in-line Vees with an angle of 90 deg. between the cylinder banks. Eight cylinders were recommended for the smaller engine and twelve for the larger. Overhead valve and camshaft construction to be used. Oiling system to be of the dry-sump full pressure type. Crankshaft is to be balanced in two planes and free from detrimental torsional vibrations.

The need for greater dust protection was emphasized by a number of speakers and the latest studies in this direction were presented in a paper "Dust Problems in Military Vehicle Operations," by L. F. Overholt, International Harvester Co. Based upon tractor experience, it is shown that the best oil-bath air cleaners will remove practically 100 per cent of dust particles larger than 10 microns in size. Moreover, commercial air cleaners remove from 80 to 85 per cent of the finer particles for an over-all cleaner efficiency of 97 to 98 per cent.

Recent investigations have proved that even the finest dust particles will produce wear and abrasion in varying degrees depending upon the type of dust. This indicates that air cleaner efficiency and application of air cleaners must be given still further attention for military requirements. The engine is not the only element of the vehicle that suffers from dust in military operations. The author pointed to the need for better protection for clutches, transmissions, electrical equipment, ignition equipment, instruments, controls, brake mechanism and servo-cylinders, and cooling systems.

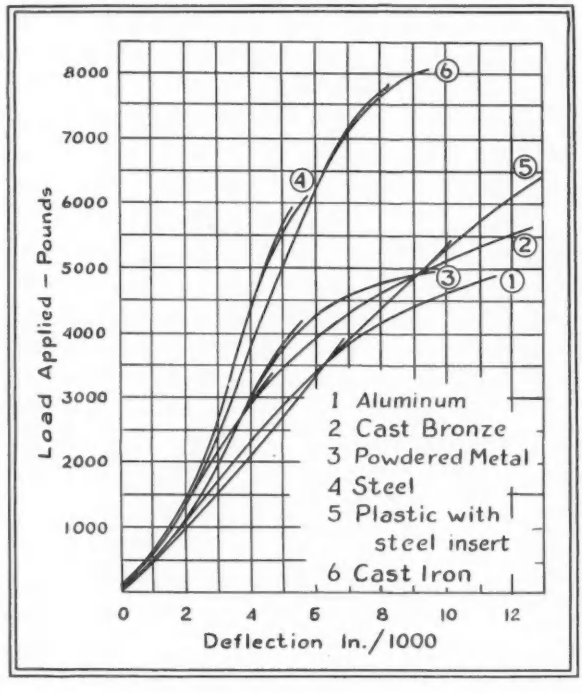
An interesting look behind the scenes of future developments in tank design was provided by Lt. Col. J. M. Colby, T-A-C, in a paper entitled, "Suspensions for Tracklaying Vehicles." He intimated that with the increasing weight of medium tanks and the demand for still greater mobility, the trend of design is away from bogie suspensions and in the direction of flexible suspension systems of the independent suspension type. Col. Colby indicated that a great deal of attention has been given to flexible suspension systems, but that the refined type of bogie design has persisted due to its simplicity of maintenance and economy of hull space. Col. Colby outlined the set-up at T-A-C in which suspensions constitute one major activity. Suspensions are evaluated according to the following essential characteristics:

1. Military requirements: Effect on fire power, mobility, protection.
2. Mechanical: Reliability, simplicity, accessibility.
3. Component: Minimum weight, minimum bulk, functional suitability.

Crystallizing the results of a decade of research has been done in excellent fashion by J. O. Almen, General Motors Research Laboratories, in a paper "Shot Blasting to Increase Fatigue Resistance." This presentation supplements an earlier report on the same subject which appeared in the Feb. 1, Feb. 15 and May 1 issues of AUTOMOTIVE AND AVIATION INDUSTRIES.

In the interest of the general conservation problem in the USA, Chrysler Corp., undertook an extensive investigation of the feasibility of substitutes for aluminum in brake cylinder pistons. The investigation included strength, stroking and corrosion tests. Deflections were measured for various loadings on pistons of different materials and the results are shown on the accompanying chart. Yield points are noted where the curves deviate from the straight line. The test fixture used for making the strengths tests also is illustrated. As a result of this project, J. F. Bachman reported the following findings to date:

1. Tin plated cast iron pistons were found to be the most satisfactory substitute for aluminum wheel cylinder pistons.
2. Tin plated steel pistons are satisfactory; however, they present a difficult handling and inspection problem as the slightest nick or



Brake wheel cylinder piston test

burr may scratch the cylinder bore and cause a leak.

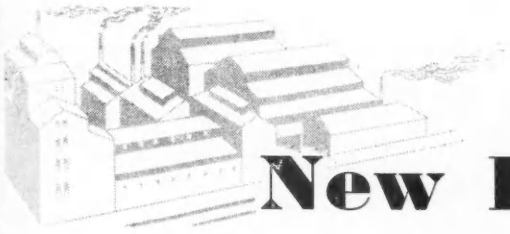
3. Durez plastic with hardened steel insert is possibly a good substitute; however, more experience is desired.
4. All other materials tested can, at this time, be considered unsatisfactory as a substitute material.

At the Production Session, O. J. Snyder, chief inspector, Cadillac Motor Car Div., summarized progress in inspection methods up to the present day with special emphasis upon the role of Cadillac in establishing standards of quality and interchangeability on an extremely high plane. Mr. Snyder attributed the present day progress in quality level to the constant search for improved methods and to the introduction of modern methods for controlling and inspecting quality.

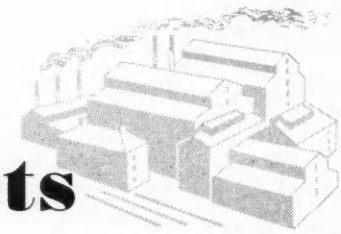
The same session was presented with an interesting discussion on the subject of statistical quality control in mass production by Capt. F. A. Gitzendanner of T-A-C. In his talk, the author pointed to the need for a better control of quality in components made in large quantities which make 100 per cent inspection uneconomical. He urged industry to study the statistical method as a practical and workable tool, intimated that the Ordnance Department will require its suppliers to use sampling inspection methods which have been devised by Army engineers. The Ordnance procedure is outlined in a special table "Standard Sampling Inspection Tables" for normal lot-by-lot acceptance inspection, issued Feb. 15, 1943.

The following manufacturers exhibited at the Cleveland SAE Meeting

DeLuxe Products Corp.	oil filters
Leece-Neville Co.	heavy duty electrical equipment
Air-Maze Corp.	air cleaners
Fram Corp.	oil filters
Hercules Motors Corp.	engines
Pesco Div., Borg Warner Corp.	pumps
Cleveland Diesel Div., GMC	Diesel engines
Thompson Products Co.	valves and engine parts
Aluminum Co. of America	castings
Cleveland Tractor Co.	tractor equipment
Gulf Refining Co.	fuels and lubricants
Cities Service Oil Co.	fuels and lubricants

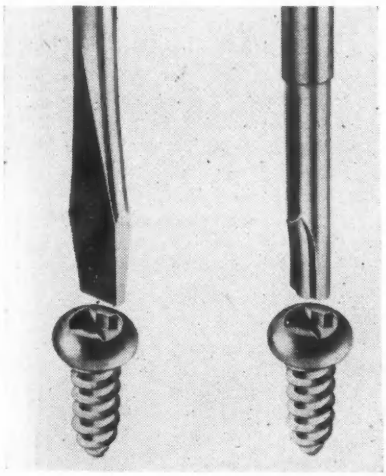


New Products



New Clutch Head Screws

The United Screw and Bolt Corporation, Chicago, Ill., has just brought a line of recessed head screws called Clutch Head Screws. A feature of these screws is that either an assembly bit or a standard screwdriver may be used to install or remove them. When the assembly bit is used, a slight reverse movement of the screw locks it to the bit, where it remains until the power of driving automatically releases it. Three sizes of driver bits cover the popular range of all standard machine, wood and thread-forming screws.



Clutch Head Screws made by the United Screw and Bolt Corporation

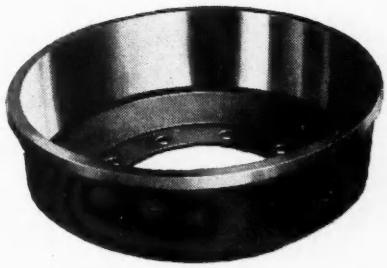
Gaskets Made of Copper Mesh

Gaskets made of copper mesh coated with synthetic rubber are a recent development of The Detroit Gasket and Manufacturing Company, Detroit, Mich. The copper screening is 80-mesh, and the thickness of the gaskets is less than .015 in. These gaskets are being used on airplane engines where their high tensile strength, flexibility, resiliency, oil resistance, dimensional stability and accuracy prevent losses of oil by seepage, blowouts, or similar causes.

Rubber Substitute Made in Paint Plant

A rubber substitute that can be made in paint factories from vegetable oils and without the use of critical materials, has been developed by the Sherwin-Williams Company, Cleveland, Ohio. This new product, which is known as Kem-Pol, is made in four different types, and is suitable for cements, stoppers, erasers, floor mats, tapes, and other civilian and war products. The Kem-Pols are not synthetic rubber, but are substitutes, replacements and extenders for natural, synthetic and reclaimed rubbers where lower tensile strength and elongation are permissible.

The four different types of Kem-Pols are identified as follows: Kem-Pol No. 14 is a viscous liquid, amber in color. It is intended for use as an adhesive. Kem-Pol No. 54 is of intermediate viscosity, and may be used as an adhesive or may be cured and milled and molded. Kem-Pol No. 11 is the most viscous of the untreated polymers. Its preferred use is in the preparation of mill stocks and molded goods, although it may be used in adhesives. Kem-Pol No. 11-41 MP is based on Kem-Pol No. 11, and represents this polymer in a pre-cured state. It may be worked directly on the rubber mill, without pretreatment.



Brake drums engineered and made to the specifications of axle and truck manufacturers are being offered by the Brillion Iron Works, Inc., Brillion, Wis. Illustrated here is one of the new cast iron brake drums now being made for an axle manufacturer.

Electrical Method for Studying Oil Film Thickness

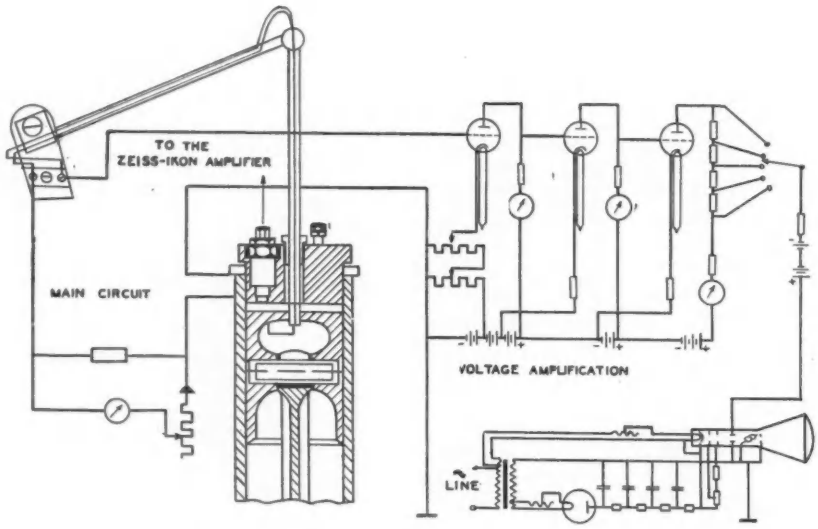


Fig. 1—Experimental setup for recording changes in electrical resistance between piston ring and cylinder wall.

IN THE past the state or condition of the lubricating film between metallic surfaces usually has been judged by the friction coefficient. From experimental observations we know that as the load on a bearing is increased and the film thickness is reduced in consequence, the friction coefficient decreases down to a critical point at which the high points of the opposing surfaces seem to come in metallic contact. If the load is increased further, the friction coefficient increases rapidly. The region below the critical point, in which the friction coefficient is higher than at the critical point, is known as that of boundary lubrication.

Another method of studying lubricating-film conditions has been developed by R. Poppinga and was described by him in an article in *Automobiltechnische Zeitschrift*. A translation of the article has been made available to us through the British Ministry of Aircraft production. The method consists in recording variations in the electrical resistance of the conducting path between piston ring and cylinder wall due to variations in the oil film thickness. The piston ring and cylinder are connected in parallel with a so-called limiting resistance R_v and in circuit with a source of current. Connections are made to the ring and the cylinder, and the resistance variations due to variations in the oil film are amplified and then recorded over the crank angle by means of a cathode-ray oscillograph. From the oscillograms thus obtained, the influence of the instantaneous piston speed on the oil film can be clearly recognized in every case. A diagram of the experimental setup employed is shown in Fig. 1.

At the low operating speed of 30 rpm the electrical resistance is very low throughout the stroke, indicating that boundary lubrication is then practically continuous. As the piston approaches the point of maximum velocity (about 45 per cent of the stroke from top dead center) there are indications of the formation of a load-supporting fluid film which introduces an electrical resistance between ring and cylinder wall. This effect is more pronounced at the higher speeds and then extends close to both ends of the stroke. At the ends of the stroke, however, when the ring momentarily comes to a standstill, the resistance drops practically to the short-circuit value R_v, indicating that there is then no fluid film between the sliding surfaces. The conclusion is drawn that in the dead-center position the condition of true fluid friction is never attained. Even at the highest speed reached in the experiments, 60 rpm, the insulating fluid film forms only gradually.

The question as to whether at the end of the stroke there is true metallic contact or whether the oil film becomes so thin that it is pierced by the low available electric potential (2.7 millivolt) is left open by the author, who says that at least the film is so thin that wear is involved.

By means of the new method the effect of gas pressure in the ring grooves can be plainly shown. Diagrams were taken during two engine starts, one without compression in the cylinders, the other with a compression pressure of 735 psi. Portions of these diagrams relating to the beginning of the starting period (when the speed is low) are reproduced in Fig. 2. When starting with compression, the conditions near top dead center are very unfavorable to film formation, since the gas pressure is high and the sliding speed low. In the upper half of the chart a diagram of cylinder pressure is shown below the diagram or trace of electrical resistance, and it will be seen that the moment of minimum electrical resistance practically coincides with the moment of maximum rate of pressure rise. Although there is a further rise in pressure beyond this point, the resistance decreases, until the end of the stroke is reached, when the entire cessation of sliding motion causes another drop in the electrical resistance to R_v. Beyond this point the oil film tends to

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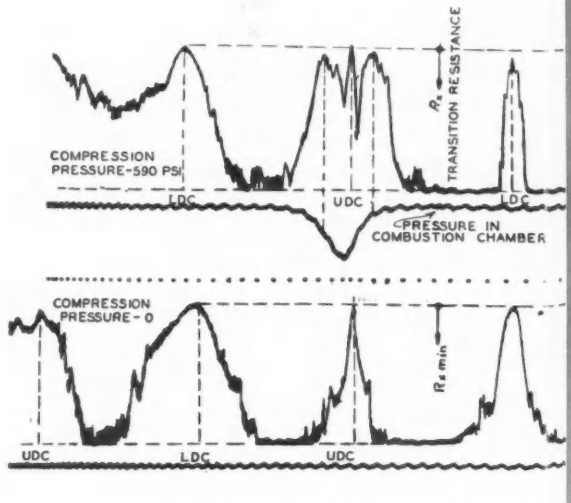


Fig. 2—Traces of electrical resistance between piston ring and cylinder wall during an engine start with and without compression.

With the engine at a standstill the electrical resistance Rx min is equal to 4.2×10^8 ohm.

Less Objection Than Formerly To Controlled Materials Plan

Second Half of Year Brings Many New Problems For War Metal Buyers as Well as for Producers

By W. C. Hirsch

The feeling is general that the beginning of the second half of the year ushers in a period of many new problems for the war metal buyer no less than the producer. Recent expressions of anxiety by high-placed officials lest there be a let-down in output have added to the uneasiness. Coming into full effect of the Controlled Materials Plan, with requirement control based on steel, copper, and aluminum, can hardly be expected to do more than clarify the industrial rationing program, although there has been a decided softening in the attitude of many former objectors. This, it is stated, resulted from eleventh-hour modifications of CMP regulations, which are now thought to be fairly well understood by the management of larger as well as smaller war contract plants.

Just what the effect of the request made by the Truman Committee of the Senate for a report by Sept. 1 of inventories and supplies held by the Army and Navy will be on the metal situation, cannot be appraised until the committee releases its information and conclusions. Already it is pointed out, however, that inventories may undergo considerable changes during the period of stocktaking and that the findings can hardly be dished up, so as to shed full light on the situation without divulging information that would be useful to the enemy. Steel producers have been told to ease pressure by adding 1,000,000 tons to what they had planned as third-quarter output. To accomplish this, as much as possible of additional capacity under construction is to be speeded up, especially with a view to increasing the number of active open-hearth and blast furnaces. Efforts are also to be made to bring about more of a switch from alloy to carbon steels in as many uses as possible, this because it takes longer to make alloy than carbon steels and entirey aside from the critical situation in the supply of many alloying elements. J. A. Krug, W.P.B. program vice chairman, told the Automotive Council for War Production the other day that it had been necessary to scale down the requests of the Army, Navy, and other Government agencies for third quarter deliveries of carbon steel to the extent of as much as 25 per cent. Backwardness in parts of the production program reaches down

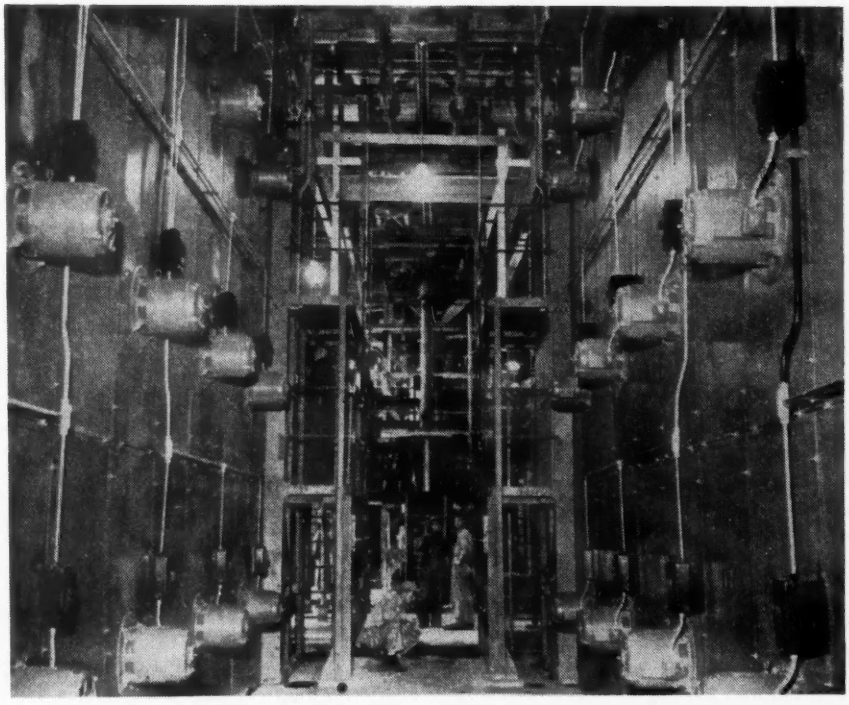
(*Turn to page* 50, *please*)

Three New Divisions Of Bell Aircraft Corp.

Establishment of three divisions to cover Bell Aircraft Corporation's construction of fighter planes on the Niagara Frontier, manufacture of ordnance equipment, and building of super bombers at Marietta, Georgia, was announced by Lawrence D. Bell, president and general manager of the Company. Formation of these three major divisions was necessitated by the growth of the Company on the Niagara Frontier and in Georgia, as well as the increasing activity of the Ordnance Division, Mr. Bell said.

Ray P. Whitman, first vice-president of the Company, in addition to holding this position, becomes manager of the Niagara Frontier Division, which includes plants at the Niagara Falls airport, and Elmwood Avenue and Main Street in Buffalo. Vice-president and Assistant General Manager Omer L. Woodson becomes vice-president and manager of the Georgia division, embracing the activities at the Bell bomber plant at Marietta, Georgia. Carl P. Lozon continues as manager of the Company's Ordnance Division.

Charles L. Beard, secretary and treasurer, will assume new duties as administrative assistant to Mr. Bell. Under the new arrangement, Mr. Beard will head the Home Office Staff which will coordinate activities of all plants. One of Bell Aircraft's first associates, Mr. Beard has directed the Company's fiscal activities through a period beginning with a few hundreds of thousands until now annual business is reported in excess of a hundred million.



72,000 Pounds of Synthetic Rubber Each 24 Hours

Synthetic rubber is dried by passing back and forth three times in these giant driers at Institute, W. Va., each capable of handling 3,000 pounds of rubber an hour. Each drier is equipped with 33 fans, and 140 tons of water are evaporated each day. World Wide Photo.

Hildreth President of A.B.P.

Joseph S. Hildreth, vice-president of the Chilton Company, was elected president of the Associated Business Papers at the annual meeting of that organization. Other officers elected were: Kingsley L. Rice, president of Technical Publishing Co., vice-president; M. A. Williamson, vice-president of McGraw-Hill Publishing Co., treasurer. The retiring president, Earl Shaner, president and treasurer of the Penton Publishing Co., was named chairman of the board.

Joseph Hildreth, the new A.B.P. president, has been engaged in the field of business and industrial magazine publishing for some 35 years. After serving as advertising manager and as publisher of other business magazines, he joined the Chilton Company in 1918. Since 1924 he has been a director and vice-president of the parent company and, for several years past, president and general manager of its Automotive Division, which publishes AUTOMOTIVE and AVIATION INDUSTRIES, *Commercial Car Journal, Motor Age, Automotive Buyer's Guide, Chilton Flat Rate and Tune-Up Manual,* and other automotive service publications.

Airplane Production in 1943 Expected to Reach 100,000

Cost of Aircraft Will Be $20,100,000,000 in 1943, Equal to One-fifth of War Expenditures

U. S. aircraft production is expected to attain a peak of $20,100,000,000 in 1943, according to OWI. This will be nearly one-fifth of the year's estimated war expenditures of $106,000,000,000 and calls for output of approximately 100,000 planes during the year. Value of aircraft and related munitions produced in 1942 was $9,200,000,000, with total output numbering 47,694 planes, Donald M. Nelson, chairman of WPB, stated in a report to President Roosevelt on 1942 war production and 1943 prospects. This compared with the 1941 total of $2,200,000,000 and 19,403 planes. Aircraft comprised 26 per cent of the 1941 munitions production program and 30 per cent of the 1942 program. Aircraft output in April, 1943, totaled $1,649,000,000, or 33 per cent of all munitions turned out in that month.

Nelson's report pointed out that the early objective in 1942 was 60,000 planes but this fell short by 20½ per cent because of shortages developed in machine tools, several critical parts and accessories, some types of fabricated aluminum, alloy steel forgings and in skilled workers. During 1942 bombers took precedence over certain other types of aircraft. Output of spares, aircraft ordnance and other equipment and maintenance items increased more rapidly than production of planes. As an example of 1942 production falling short of too optimistic schedules, output of 2-engine medium bombers was 137 per cent of the forecast for the first quarter of 1942, 95 per cent of schedules for the second quarter, 84 per cent for the third quarter and 72 per cent for the fourth quarter. However, actual output increased almost constantly. Scheduling was unrealistic.

From July 1, 1940, to Dec. 31, 1942, approximately two out of every five bombers and pursuit planes off U. S. production lines went to other of the United Nations. One out of every 10 service combat planes, one out of every six trainers, one out of every three medium tanks and two out of every five light tanks also were exported under lend-lease. In 1941 about 66 per cent lend-lease. In 1941 about 66 per cent of military consumption of aluminum was for aircraft but in 1942 this had increased to 80 per cent. U. S. production of aluminum advanced 77 per cent in 1942, magnesium output climbed 220 per cent, chromite was up 700 per cent, alloy steel increased 38 per cent, and molybdenum, tungsten and vanadium

(*Turn to page* 54, *please*)

Lockheed Purchases Stock of Transamerica

Lockheed Aircraft Corporation has acquired the majority interest in Pacific Finance Corporation of California through the purchase of stockholdings of Transamerica Corporation and associates.

This announcement was made following a meeting of the directors of Pacific Finance, at which time resolutions were adopted calling a special meeting of the corporation's stockholders on June 23 to make callable the Series A and C preferred stock, and to authorize the reduction of the capital of the corporation by the retirement of not to exceed 182,852 common shares. The reported consideration for the 381,205 shares involved in the sale was $15.25 per share, and it was indicated that the aircraft company will shortly offer a similar price to minority common stockholders for the shares they hold. However, after retirement by Pacific Finance Corporation of the common shares, Lockheed's investment in the company will amount to approximately $3,750,000.

The Pacific Finance board appointed Robert E. Gross, Courtlandt S. Gross, Charles A. Barker, Jr., Cyril Chappellet and Corson W. Ide, as directors at meeting to fill existing vacancies.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

General business activity remains at a high level, although a rather marked decline is indicated for the week ended June 5 (a holiday week). The *New York Times* seasonally adjusted index for that period stands at 137.1, as against 140.7 for the preceding week and 131.0 a year ago.

Active buying of summer goods has sustained retail trade at high levels, according to current reports. Department store sales reported by the Federal Reserve Board for the week ended June 12 were 28 per cent larger than in the corresponding period last year, this gain comparing with one of 2 per cent in the preceding week. Sales for the four weeks ended on that date were 22 per cent larger than a year ago, and the total for the year to date is 13 per cent above the comparable 1942 figure.

Railway freight loadings for the week ended June 12 totaled 854,486 cars, showing a rise of 28 per cent from the figure for the preceding (holiday) week and a gain of 2.6 per cent above that for the like period of last year.

Electric power production during the same period increased more than seasonally and was 16.7 per cent greater than a year ago. For the preceding week a comparable gain of 16.4 per cent was reported.

Crude oil production during the week ended June 12 averaged 3,987,800 barrels daily. This figure is 54,850 barrels above that for the preceding week and 287,450 barrels above that a year ago but is 231,100 barrels below the output recommended by the Petroleum Administration for War.

The strike in the bituminous coal mines reduced the average daily output for the week ended June 5 to 526,000 net tons, as compared with 1,990,000 tons a week earlier and 1,839,000 tons a year ago. Total output for the week was the lowest in more than two years.

Engineering construction contracts awarded during the week ended June 17 amounted to $44,234,000, according to *Engineering News-Record*, showing a drop of 37 per cent from the figure for the preceding week and a decline of 72 per cent below that for the corresponding period last year.

Professor Fisher's index of wholesale commodity prices for the week ended June 11 remained unchanged at 112.3 per cent of the 1926 average, as against 106.6 a year ago.

Member bank reserves increased $346,000,000 during the week ended June 16, mainly because of large Treasury disbursements, which resulted in a decline of $169,000,000 in Treasury deposits with the Federal Reserve banks. Excess reserves rose $120,000,000 to an estimated total of $1,630,000,000. Business loans of reporting member banks during the preceding week declined $25,000,000 and stood $1,287,000,000 below the total a year earlier.

Mattix Joins A.M.A. Export Department

Paul R. Mattix, formerly Chief, Automotive Division, Bureau of Foreign and Domestic Commerce, Department of Commerce, has joined the staff of the Automobile Manufacturers Association in the capacity of manager of the Export Department and secretary of the Export Committee.

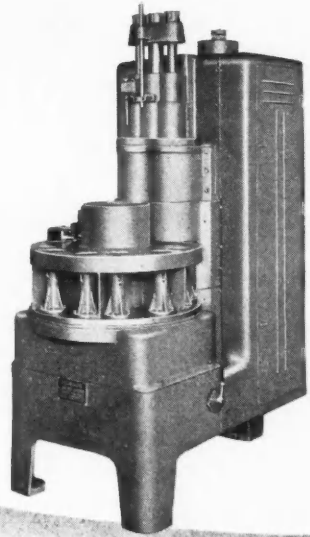
DENISON EQUIPMENT *in* APPLIED HydrOILics

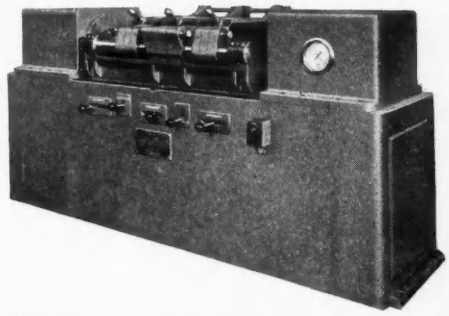
TRADE MARK

Industrial Presses — Shell Loading Presses — Crank Shaft Assembly Presses . . . three of many Denison HydrOILic Presses.

AT WORK . . . *all across the country*

In war plants from coast to coast . . . and in actual warfare . . . Denison HydrOILic equipment is pressing, packing, assembling, testing. These are just a few of the many victory tasks being efficiently handled by Industry's New Right Hand . . . Oil Hydraulics!

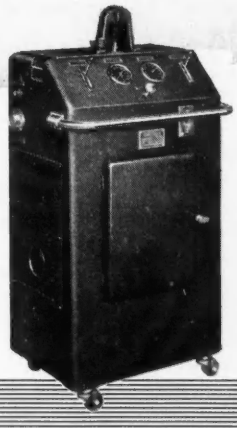




Wartime applications of HydrOILics foreshadow the part they will play in post-war production. They will help produce more goods faster and cheaper, replace old equipment, make new products and processes possible . . . for oil-hydraulic power, *and precision control of that power*, have just begun to accomplish the many things never before possible with other mechanical methods.

Wherever smooth, exactly-controlled power is needed for pressing, pulling, clamping, positioning, or moving . . . HydrOILic equipment offers a better way. Pioneers in oil-hydraulics, Denison Engineers are fully qualified to adapt HydrOILics to your specific needs . . . Denison plants are completely equipped to build from their designs—NOW, if your priority permits! Whether it be for today's war, or tomorrow's peace, learn what HydrOILics can do for your processes . . . write today!

Here are three Denison HydrOILic Test Stands playing vital wartime roles . . . testing aircraft magnetos — hydraulic circuits — spark plugs.



The **DENISON ENGINEERING** *Company*
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Drastic Steps Urged to Prevent "Unauthorized" Work Stoppages

George F. Addes, Secretary-Treasurer of UAW-CIO, Asks for Elimination of "Wildcat" Strikes by Union Members

Pointing out the need for discipline within its own ranks, George F. Addes, director of the war policy division and secretary-treasurer of the UAW-CIO, urged that drastic steps be taken to eliminate unauthorized work stoppages among the union's members at the quarterly executive board meeting of the union in Toronto. Addes' proposal followed an outbreak of wildcat strikes in midwest automotive and rubber plants. Most serious were those at Chrysler, Packard and four large Akron rubber companies, but also affected were Timken-Detroit Axle Co., Kelsey-Hayes Wheel Co., Spicer Mfg. Co., Electric Auto-Lite Co., Toledo; Muskegon Motor Specialties Co., Budd Wheel Co., Timken Roller Bearing Co., Bay Mfg. Division of Electric Auto-Lite and Warner Gear Division of Borg-Warner Corp.

"Those who say that stoppages of work have little effect on the war effort are only allying themselves with our enemies," asserted Addes. "Even if they have little effect on total production, the effect they have on other millions of war production workers and on the public in general must be taken into consideration. They undoubtedly stir up unrest among these workers and, by leading others to believe they can do likewise, directly and indirectly cut down the production that is so badly needed. No organized body can long exist without discipline within its own ranks."

Addes said the board in 1939 had adopted a resolution on wildcat strikes which states that "when any members violate provisions of the unauthorized strike policy, they should be penalized by the international union." He urged that the board take positive steps to make that resolution effective. Disiplinary action within the union against instigators of wildcat strikes has been notably lax although the Army Air Forces, through Col. George Strong, ordered the firing of wildcat strike leaders at the Buick aluminum foundry in Flint and the Bohn Aluminum & Brass Corp., Detroit.

One of the most active advocates of union discipline against wildcat strikes has been Leo Lamotte, director of the Chrysler Dept., who engaged in an intra-union controversy with Walter Reuther, GM Dept. director and UAW-CIO vice president, during the recent Chrysler strike. Early in January Lamotte suspended a shop steward at the Chrysler Tank Arsenal for 10 days for instigating a work stoppage. The Tank Arsenal Local 833 took the issue to the previous executive board meeting at Columbus, Ohio, asking that Lamotte be removed and that he be required to reimburse the steward for time lost. The executive board upheld Lamotte, 20 to 2, and suggested a revision in the union's constitution which requires a long and involved fair trial procedure before a member can be disciplined.

The Toronto executive board meeting declared disapproval and condemnation of Lamotte for public charges blaming Reuther for the recent Chrysler strike but it approved Lamotte's activities in handling the strike and the affairs of the Chrysler Dept. Lamotte's ouster had been demanded by two Chrysler Corp. locals. Lamotte denied that he had implied Reuther was directly re-

(*Turn to page* 52, *please*)

Lord Perry Wants Car Exports Limited

In an interview published in a British export journal, "Great Britain and the East," Lord Perry, head of the Ford organization in Europe, urges that America should limit the export of passenger cars, as they are not vital either to the American automobile industry or to the United States as a whole. "The problem of the United States after the war," he says, "will be not what I can sell, but what I must not sell. . . . To go on selling things and hoarding up gold is futile. America must buy back goods to the volume of her exports. The amount to be exported will be limited by what can be imported, and there are a number of basic exports which rank long before motor cars." He named cotton, tobacco, wheat and meat as among these priority exports, and added that, if America decides not to export motor cars, the older motor manufacturing countries, like Germany, Italy and France, will offer no unbeatable competition with Britain, despite their cheaper living conditions.

Boyer Resigns from Ford

Robert A. Boyer, thirty-three-year-old research chemist who developed the material for the Ford plastic automobile body that was first displayed in August, 1941, has resigned his position with the Ford Motor Co., effective July 1. Boyer went to Dearborn from his home in Framingham, Mass., in 1928 as a protege of Henry Ford. As director of the research laboratory set up in 1930 to find industrial uses for farm crops, he perfected processes for extracting soybean oil, developed a soybean water paint and a synthetic fiber suitable for automobile upholstery and worked on a method for producing iron from low grade ores. The plastic body car upon which Boyer worked was composed of 14 plastic panels, made from a mixture of synthetic resin and fibrous material derived from wheat, flax or similar crops, mounted on a tubular welded frame. In 1940 Boyer was given the distinguished service award granted annually to the outstanding young man of the nation by the U. S. Junior Chamber of Commerce.

A.C.W.P. Holds Annual Meeting

Charles E. Sorensen, Vice-President of Ford Motor Company, Elected to Board of Directors of A.C.W.P.

The automotive industry has doubled its production of war materials in the last 12 months, Alvan Macauley, president, told the annual meeting of the Automotive Council for War Production, June 17, at Detroit. Its present output is double the highest level of civilian automobile production ever attained and employment now totals almost 1,250,000 men and women.

Macauley said the voluntary cooperation by the council's 500 participating companies "should unquestionably show a balance sheet of eliminated manhours, improved machinery and production methods, improved and substituted materials, that would compare more than favorably with, let us say, the entire savings to the government through renegotiation of contracts or any similar group of economies one might name."

He asserted that the same cooperative action used on methods, machines and materials is being applied to the potential shortage of manpower and also will be applied to procedures necessary to make a more orderly transition from war to peace than that which occurred at the close of the last war.

"Unless something far different, far more responsive to needs than has so far been put into operation, is developed for the orderly liquidation of the present total war production job," concluded Macauley, "there can be no blinking the fact that the consequences will be ruinous."

C. E. Wilson, president of General Motors and chairman of the ACWP Manpower Committee, said he could not foresee any serious interruptions to the industry's war production in the immediate future because of a diminishing number of workers. Because the nation is near the bottom of the reservoir of employable males, Wilson said it would be necessary to accept many whose physical disabilities or over-age status would have precluded their em-

Helping to "BRING 'EM BACK ALIVE"

Nothing in this war is more heartening than the large number of pilots and plane crews who come back alive from missions of extreme hazard.

Case after case has occurred where planes suffered terrific punishment, yet the pilots managed to bring them home. It is a tribute to the splendid skill of our pilots and the remarkable quality of our planes.

Vickers Hydromotive Controls are an important factor in the exceptional quality of many American combat planes. These high pressure oil hydraulic controls are dependable, accurate, easy to operate, easily adjusted, insensitive to shock and vibration . . . reliable no matter how tough the going.

Vickers Hydraulic Equipment is also used to advantage for the control of many types of production machines . . . machines that are helping win the war . . . machines that will help win the peace.

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ployment in peacetime. The biggest source of new workers, he pointed out, is among women, who at the present time comprise 25 per cent of all persons employed in manufacturing in the U. S. Industry has anticipated the employment of women by rearranging and reprocessing the work so more jobs are suitable for women.

J. A. Krug, program vice chairman of WPB, warned that the material situation is not easing up. He pointed out it has been necessary to scale down by 25 per cent the requests by the Army, Navy and other claimant agencies for carbon steel in the third quarter of 1942. He said the situation in aluminum and copper is even tighter and he foresees no immediate relief. Requests for carbon steel in the third quarter totaled 20,000,000 tons against available supply of 15,000,000 tons. The Army's request was cut 500,000 tons, that of the Navy 100,000 tons, the Maritime Commission was 400,000 tons short and ODT received only 1,200,000 tons for expanding transportation needs against a request for 2,200,000 tons.

Charles E. Sorensen, vice-president of Ford Motor Co., was elected to the board of directors of the ACWP, assuming the vacancy left by the death of Edsel B. Ford. All other officers and directors of the Council, headed by President Macauley, were reelected.

Speakers at the one-day session included Maj.-Gen. Lucius D. Clay, director of materiel for the Army Service Forces; Lawrence A. Appley, executive director of WMC; J. A. Grug, program vice chairman of WPB, and Courtney Johnson, chairman of the ACWP materials control committee. Four officers from the Ordnance Dept. Tank-Automotive Center addressed the meeting on maintenance problems. They were Brig.-Gen. S. E. Reimel, on tank, combat vehicle and truck maintenance operations; Col. Graeme K. Howard. on replenishment parts requirements; Col. C. G. Fegan on the military parts supply set-up, and R. K. White on the spare parts policy.

Awards

Names of winners of Army-Navy "E" awards in or allied with the automotive and aviation industries, announced since the June 15 issue of *Automotive* and *Aviation Industries* went to press.

BLAW-KNOX COMPANY, Blawnox, Pa.
WILLIAM D. GIBSON COMPANY, Chicago, Ill.
GRAHAM PAIGE MOTORS CORPORATION, Detroit, Mich.
HERCULES POWDER COMPANY, Belvidere, N. J.
WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Newark, N. J.

Less Objection to CMP

(*Continued from page* 45)

to primary, basic materials. The Great Lakes iron ore movement, in spite of all efforts by ODT Director Eastman to speed it up, still runs several thousand tons short of the 91,000,000-ton rate set for the current season.

What WPB Executive Vice Chairman Charles E. Wilson has referred to as "the very tight aluminum forgings and extrusion situation," is being relieved by the effective teamwork of the members of the recently appointed Aircraft Aluminum Products Control Committee, on which all of the armed services as well as the leading aluminum producers and fabricators are represented. Speeding up in the production of heavy bombers is one of the major objectives of the Aluminum Products Control Committee. OPA has repriced all forms of secondary aluminum. The maximum base price of secondary aluminum ingot has been reduced 1 cent a pound to the present 14-cent level of primary aluminum in "pig" form. The price changes were made to accelerate the flow of aluminum scrap to secondary refineries and of the reclaimed ingots back into consumption.

Conferences between officials of the Government's Metals Reserve Company and Bolivian tin producers regarding an increase in the price of 60 cents a pound, f.o.b. South American port, now paid for Bolivian concentrates, continue. Although this represents a 25 per cent advance over the 48½ cents, c.i.f. American ports, which the contract made in November, 1940, provided, the Bolivians now claim that they cannot make both ends meet even at 60 cents.

War Plant Expansions

General Motors Corp. has received a Defense Plant Corp. grant of $11,300,000 for additional plant facilities in Ohio, presumably at the Fisher Cleveland Aircraft plant, which is scheduled to produce super-bombers. This brings the total commitment to $24,500,000. Studebaker Corp. has been awarded an increase of $3,600,000 for additional facilities in aircraft engine plants in Illinois and Indiana, boosting the total to $87,000,000.

B. F. Goodrich Co. has been allotted $900,000 for machinery and equipment for a plant in Ohio. Goodyear Aircraft Corp. has had its contract increased by $450,000 for additional facilities for a plant in Arizona, raising the total to $6,400,000. Jacobs Aircraft Engine Co., Pottstown, Pa., has received $625,000 for additional facilities for a plant in Pennsylvania, making the over-all commitment $22,000,000. Air Products, Inc., Detroit, has received a contract for $225.000 to provide plant facilities in Michigan.

Manufacturing facilities of the Lycoming Division of The Aviation Corporation at Williamsport, Penna., have been expanded by the addition of a $500,000 plant, it was announced by P. E. Garlent, vice president of The Aviation Corporation and general manager of the Division.

Several additional factory buildings, including a large final assembly structure and a new office and engineering building, are under construction at the Ryan Aeronautical Company plant site on Lindbergh Field and will soon be ready for use to permit the company to meet increased production schedules.

New Onsrud Plant

The Onsrud Machine Works, Chicago, Ill., has recently opened a new plant for the production of router bits and cutters of all types and sizes. This newest Onsrud plant has freed many thousands of square feet of floor space in the main plant for the manufacture of the larger Onsrud machines.

MEN . . . . . .

Nash-Kelvinator Corp. has announced the resignation of **W. F. Armstrong** and **Frank R. Pierce** as vice presidents.

The appointment of **Franklyn Waltman** as director of public relations, Sun Oil Co. has been announced. Mr. Waltman's headquarters will be in Philadelphia. He succeeds the late Judson C. Welliver.

The Glenn L. Martin-Nebraska Co. has announced the appointment of **Charles Day** as director of the company's Modification Center.

Announcement has been made of the appointment of **Frank E. Caldwell** as service manager of Pump Engineering Service Corp.

Promotion of **Hans Lasker,** factory manager and **Henry MacDonald** assistant factory manager were among the administrative changes announced today at Republic Aviation Corp.

John R. Bangs, formerly head of the Dept. of Administrative Engineering at Cornell University, has been made general manager of industrial and personnel relations by the Edward G. Budd Mfg. Co.

The following have been elected to the Board of Directors of Doak Aircraft Co., Inc. **Nelson E. Grace,** senior vice-president and factory manager; **Leonard Comegys,** attorney. New appointments to vice-presidencies are, **Stephen F. Hinchcliffe** vice-president in charge of sales, **Eldore E. Rosier,** vice-president in charge of contracts.

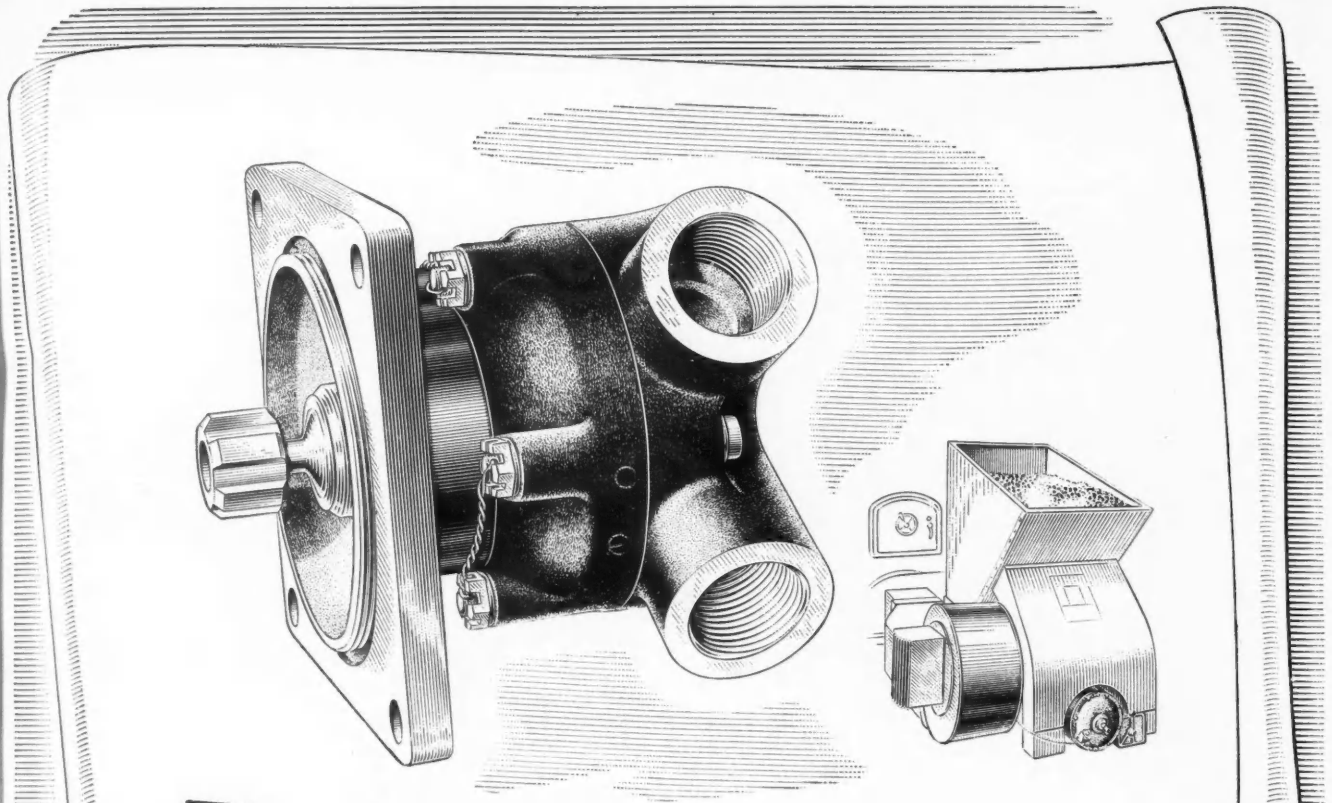
Chambersburg Engineering Co. announced the election of **Edgar S. Hutton,** as treasurer. He was formerly with Clarke-Harrison, Inc.

Chicago Molded Products Corp. has announced the election of the following officers: **Maurice C. Bachner,** chairman of the board; **Edward F. Bachner,** president and general manager; **Marcel F. Bachner,** vice-president and treasurer; **John J. Bachner** vice-president in charge of sales; **Louis H. Bachner,** secretary and assistant treasurer; **Bruce Balderson,** controller and **James T. McKenna, assistant secretary.**

H. J. Barnsley, vice-president of Jenkins Bros. has been elected to the governing board of Jenkins Bros., Ltd., Montreal, Canada.

American Brake Shoe Co. has announced the appointment of **John W. DeLind, Jr.,** as director of exports.

Kearney & Trecker Corp. has announced the election of the following officers: **J. L. Trecker,** executive vice-president. **R. W. Burk,** vice-president in charge of sales



The Aircraft Pump Learned How to Reduce from the Stoker

YOU'D hardly expect an airplane pump to have even a nodding acquaintance with a coal stoker. Down-to-earth, extremely rugged, the stoker is built with heavy service conditions uppermost in mind. It's no surprise, then, to find Torrington Needle Bearings on the job —with their high load-carrying capacities, and ease of lubrication.

With aircraft pumps, the story is somewhat different. Here the design problem was not so much one of ruggedness as keeping size and weight down to an absolute minimum. But the fact that no special means of lubrication need be provided with the Needle Bearing soon had the pump people "weighing" its other advantages, with an eye to simplifying design and increasing production efficiency.

Everyone of its features, they found, fitted right into the military airplane picture. The Needle Bearing's compactness squarely met the problem of space limitations invariably encountered in aircraft design, and contributed importantly, also, to weight-reduction. While long-life, low-cost, and ready availability for essential applications are among the significant "little things" which enabled the industry to meet and top the staggering production demands of the Government's airplane program.

NEEDLE BEARINGS— ALL TYPES—ALL SIZES

NEEDLE BEARINGS TYPE DC are complete, self-contained units consisting of a full complement of rollers and a drawn, hardened outer race. They offer the advantages of small size, low cost, high capacity—and easy installation.

NEEDLE BEARINGS TYPE NCS consist of a full complement of rollers and a relatively heavy hardened outer race. They are furnished with or without inner races. Needle Bearings Type NCS are adaptable to heavier loads than Needle Bearings Type DC.

NEEDLE ROLLERS TYPE LN are produced in a range of sizes for assembly into low-cost, high-capacity anti-friction bearing units. They are designed for use in applications which require assembly of the bearing on the job.

NOW CONSIDER YOUR OWN POSTWAR DESIGNS

Isn't there an idea in the Torrington Needle Bearing which you might use to good advantage in your postwar designs? Tomorrow's most-wanted products will be considerably lighter, yet capable of heavier loads . . . longer-lasting, yet requiring practically no maintenance attention. Let Torrington engineers show you how you can give your product these and other new-day advantages of the Needle Bearing. As preliminary information, a list of typical applications in Catalog 107 may prove helpful to you in post-war planning.

THE TORRINGTON COMPANY

Established 1866 • Torrington, Conn. • South Bend, Ind.

Makers of Needle Bearings and Needle Bearing Rollers

New York · Boston · Philadelphia
Detroit · Cleveland · Seattle
San Francisco · Chicago · Los Angeles
Toronto · London, England

TORRINGTON NEEDLE BEARINGS

E. W. Trecker, vice-president in charge of manufacturing; **J. B. Armitage,** vice-president in charge of engineering and **R. L. Bischoff,** treasurer and assistant secretary.

A. C. Herreschoff, chief engineer of research at Chrysler Corp. has been elected Detroit chairman of the Society of Automotive Engineers.

Nash-Kelvinator Corp. has announced the election of **A. M. Wibel** as vice-president.

C. K. Swafford, works manager and member of the Board of Directors of Gisholt Machine Co., was elected a vice-president of the company at its annual meeting.

Announcement is made by the Wilkening Manufacturing Co. of the appointment of **Walter A. Kirkpatrick** as public relations manager.

Climax Molybdenum Co. has announced the resignation of **William P. Woodside,** as vice-president in charge of research.

John E. Mateer has been appointed superintendent of the Open Hearth Dept., Lukens Steel Co.

Frank Armstrong, formerly promotion manager for Warner Bros. in New York City, has rejoined Arthur Kudner, Inc., in charge of public relations on the Fisher Body account in the Detroit office.

John D. M. White, formerly publicity director for Hudson Motor Car Co., has joined Ruthrauff & Ryan, Inc., to handle public relations on the Dodge, DeSoto, Chrysler and Plymouth accounts in the Detroit office.

D. C. Fenner, consultant to the Automotive Division of WPB for the last 18 months, has returned to his former position as vice-president in charge of public relations for Mack Mfg. Corp. **M. C. Horine,** sales promotion manager for Mack, has been given a leave of absence to become an automotive consultant for WPB.

Hugh Willis, formerly chief research director, has been appointed general sales manager of Sperry Gyroscope Co., Inc. **Carl Frische** will succeed Willis as chief research director. **Russell H. Varian,** Sperry researcher, has been awarded the honorary degree of doctor of engineering by Brooklyn Polytechnic Institute for his work on the Klystron tube.

Robert E. Gross, Courtland S. Gross, Charles A. Barker, Jr., and **Cyril Chappellet,** officers of Lockheed Aircraft Corp., have been elected to the board of directors of Pacific Finance Corp., in which Lockheed has purchased a majority interest.

G. E. Merkle, formerly a Chrysler distributor in Wisconsin and a past president of the Wisconsin Automobile Dealers Association, has been appointed sales manager of the Perfex Gage & Tool Co., Detroit.

E. J. Barney, formerly purchasing agent of the Frigidaire Division of General Motors, has been appointed production manager of the Detroit Diesel Engine Division. **A. A. Weidman,** formerly superintendent of the sheet metal department at the Cadillac Motor Car Division, has been named chief inspector at Detroit Diesel and **George A. Zink,** former manager of the Allison Division bearing plant, has been made works manager.

Harry G. Sparks, formerly vice-president, has been elected president and general manager of the Sparks-Withington Co., succeeding his father, the late Capt. William Sparks. **Charles J. Kayko,** head of the radio division, has been elected to the board of directors.

Louis C. Goad, general manager of the Eastern Aircraft Division, has been elected a vice-president of General Motors Corp. He was president and general manager of the AC Spark Plug Division until Eastern Aircraft was formed in 1941.

B. L. Whelan has been appointed acting general manager of the Sikorsky Aircraft Division of United Aircraft Corp., succeeding **J. Reed Miller,** vice-president, who resigned because of poor health.

Walter F. Wright, formerly chief of the automotive division of WPB in the Detroit Region, has been appointed deputy regional director for that region.

Steps to Prevent Work Stoppages

(*Continued from page* 48)

sponsible for the Chrysler walkouts but said he was indirectly guilty for urging his followers to repudiate labor's no-strike pledge. R. J. Thomas, president of the UAW-CIO, called for unity between the Reuther and Addes factions of the union, asserting the union from now on would follow a straight trade-union policy, the political affiliations of its officers notwithstanding.

Addes' financial report revealed that the union has assets of $1,203,254, including $651,048 in cash. Another $1,000,000 is expected to be added to the union's resources by the $1 assessment levied in June to further organizational efforts and build up a post-war reserve. Dues paying membership averaged 893,886 for the three months ending with April.

Twenty-seven employees of the Packard Motor Car Co., including a foreman, were ordered suspended by the Army Air Forces as the result of a four-day strike that kept 25,000 workers idle and halted production of aircraft and marine engines. The strike started in the aircraft engine teardown and reassembly dept. when white workers walked out in protest over the upgrading of three Negro employees. These men were promoted from washing parts to places on the assembly line. Later the strike spread to the rest of the plant. Some Negro workers remained at their jobs. Despite the racial issue, there was no violence. However, in spite of two directives from the National WLB, orders from the Army and pleas from union leaders, it was four days before a back-to-work movement of any size got under way. Thomas blamed the Ku Klux Klan for provoking the strike. He said Negro workers pay their $1 union dues just like any other members and have equal rights in the UAW-CIO. In February, 1942, incumbent officers of Packard Local 190 of the UAW-CIO charged the Klan with trying to take over control of the local through running Frank Buehrle for president against Curt Murdock, then president. Murdock won out.

James Colescott, imperial wizard of the Ku Klux Klan, denied his organization was responsible for the recent Packard strike but he did say, "We do have a strong representation in the UAW-CIO. We financed special courses for them, to teach them public speaking and parliamentary procedure so that they could adequately challenge Communists when they attempted to dictate local union policies from the floor of meetings." Colescott said there were no Klan chapters in Detroit, the nearest being at Flint. Several days after the strike settlement, some of the 27 suspended workers, both white and Negro, were permitted by the Army to return to their jobs.

Penalties against 13 Ford Motor Co. employees for their part in a disturbance March 3 involving a plant protection man at the aircraft engine building in the Rouge were ordered equalized in the first decision handed down by Dr. Harry Shulman, umpire on grievances between Ford and the UAW-CIO. Penalties imposed by the company had ranged from layoffs of one to four weeks to discharge for four men. Dr. Shulman reduced some of the layoff penalties to equalize the punishment and ordered reinstatement of the four men discharged but without back pay. Charging improper treatment of the plant protection man by the workers, Dr. Shulman declared, "It is no more just to smear all plant protection men as 'stooges,' 'gestapo' and so forth than it is to call union men 'racketeers'."

Replying to the recent panel decision of the WLB recommending a maintenance of membership clause, the check-off and compulsory arbitration through appointment of an impartial umpire, Chrysler Corp. maintained in a reply that these contract changes would penalize the corporation and reward the union for "irresponsibility, antagonism, striking in war-time and sabotaging the appeal boards" set up in present contracts. Referring to the recent strikes, the company said, "It appears that the union struck these war plants to enforce a demand for arbitration that a panel of the National WLB was then in the course of arbitrating."

CALENDAR

Conventions and Meetings

SAE Nat'l Tractor Mtg., Milwaukee, Sept. 23-24

SAE Nat'l Aircraft Engineering & Production Mtg., Los Angeles, Sept. 30-Oct. 2

National Safety Congress, Chicago, Oct. 5-7

Crescent Installs Special Equipment

The Crescent Company, Pawtucket, R. I., has installed additional modern equipment, among which is a special cabling machine which required nearly eight months to manufacture. This new equipment, along with other wire-making machinery which is scheduled for delivery this summer, will greatly increase Crescent production.

Obituary

Carl B. Foster, 50, office manager of the Chevrolet Motor Division engineering dept., died suddenly June 14 at his home in Detroit. He had been with Chevrolet for more than 23 years and was a former president of the General Motors Men's Club of Detroit.

Norman D. Hoke, 58, director of traffic for Chrysler Corp., died June 12 at his summer home at Portage Lake, Mich. He had been associated with Chrysler since 1920.

Your child's best friend...

THE PARASITIC FRUIT FLY, Drosophila, is perhaps the most important creature in the world to scientists today. Because its study may reveal what the character of our own children may be in the future.

Drosophila is a perfect specimen for laboratory study, because a generation flickers past in from 8 to 12 days. As a result, scientists have been able to study and record a million breedings! And the entire mechanism of heredity has thus been revealed!

But if Drosophila is a friend to mankind, consider the influence of machine tools on human welfare. Do you know why it is that some countries, so rich in natural resources, still harbor hundreds of millions living close to starvation? And why the highly industrialized countries represent the greatest advance in civilization? The answer is machine tools!

Machine tools have vastly increased the output of manufacturers and have shortened the customary hours of labor. They have **not** reduced the number of persons required to do the world's work. They **have** eliminated much of the back-breaking labor which would otherwise be required.

Cone Automatic Machine Company is proud to be a part of such an essential industry. Proud, also, to know that whatever we Americans build for the future. Cone Multiple Spindle Automatic Lathes will most certainly enter into much of its production.

ONE Automatic Machine Company, Inc., Windsor, Vermont

Airplane Production in '43

(*Continued from page 46*)

rose 40 per cent. However, material requirements are constantly being raised. Direct military needs for steel in 1943 are up 31 per cent, aluminum requirements have increased more than 100 per cent and magnesium is up considerably over 200 per cent. The 1943 war program calls for combat planes whose value is 3½ times that of 1942 output; for spare propellers, engines and parts 2.7 times the 1942 total, and for plane equipment and maintenance almost four times the 1942 figure.

In reporting on April munitions production, Nelson said that aircraft output was up 8 per cent over March. Heavy bomber production increased 18 per cent and that of one-engine Navy fighter planes was up 50 per cent. He pointed out that the difficulties of attaining 1943 aircraft goals in view of the fact that only 19 per cent of the year's objectives for combat planes was reached in the first four months of 1943. Similarly, 20 per cent of the service plane goal and 36 per cent of that for trainers were reached. He said the attainment of these goals will depend upon the rapidity with which we are able to bring new plants into production.

Total munitions output for April was up 7 per cent over March. Output of automotive vehicles and equipment gained 9 per cent. April machine tool shipments totaled $118,031,000, 5.9 per cent less than March. The backlog of orders at the end of April totaled $643,643,000, which could be produced in 5½ months at the April rate.

Although tank schedules and certain other munitions have been revised downward in recent months, C. E. Wilson, vice chairman of WPB, told the Economic Club of Detroit there is no slackening of war production in prospect. He said only 19 per cent of 1943 munitions production was completed in the first quarter. The 1944 production schedules are 24 per cent ahead of 1943 and the 1944 aircraft program calls for a doubling of 1943 output. Schedules for next winter call for 40 per cent more munitions output than current monthly totals. In the field of cargo aircraft, 1 million deadweight tons were produced in 1941, 8 million deadweight tons in 1942 and output in the first half of 1943 was 12 per cent above that for all of 1942.

The reason for the great increase in Navy fighter plane output in April was explained by Rear Admiral R. E. Davison, chief of the Navy's Bureau of Aeronautics, before the war material meeting of the SAE at Detroit. He said that the naval combat aircraft program is characterized by the widely separated manufacture of planes of proven design. As an example, the Vought-Sikorsky Corsair, designed and produced by the Chance Vought Division of United Aircraft Corp. at Stratford, Conn., is also being manufactured by Brewster at Johnsville, Pa., and by Goodyear Aircraft Corp. at Akron, Ohio. Important airframe and wing sections are made by Briggs Mfg. Co. at Detroit and Willys-Overland at Toledo. Chrysler supplies parts, Libby-Owens-Ford shares in the responsibility and Woodall Industries, Inc., of Detroit, makes intricate internal airframe parts. Similarly, the Eastern Aircraft Division of General Motors is producing Wildcat fighters and Avenger torpedo bombers designed by the Grumman Aircraft Engineering Corp.

Nash-Kelvinator Corp., already producing 2,000-hp. Pratt & Whitney engines and Hamilton Standard propellers under license from United Aircraft Corp., has added a third United product with announcement that it will make Sikorsky helicopters for the armed services. When mass production is achieved, it will exceed that of the parent Sikorsky Division of United Aircraft, which recently moved to a plant in Bridgeport, Conn. The helicopter which Nash will build represents an advance over the model which the Army recently tried out at Wright Field. The latter had a rotor span of 36 feet, overall length of 38 feet and gross weight of 2,400 pounds. Nash is the first automotive company to enter the helicopter field. Manufacture probably will take place in Grand Rapids or Detroit.

BOOKS . . . .

ESSENTIALS OF INDUSTRIAL HEALTH, *by C. O. Sappington, M.D., Dr. P.H. Published by J. B. Lippincott Company, Philadelphia, Pa. Price $6.50.*

In this book, which comprises 603 pages, the author shows that industrial health goes beyond the ordinary practice of curative medicine and surgery in industry, running the gamut as it does from historical foundations down through the modern era of interest in economics and sociology; the development of industrial-health specialties with particular emphasis on industrial hygiene and toxicology; the development of sanitation and health-conservation procedures; the role of illumination and ventilation, nutrition, housing, recreation, fatigue control, mental hygiene, and vital statistics. Also covered are codes, regulations, and factory inspection; job analysis, aptitude and psychologic tests; the significance of industrial accidents, occupational diseases, non-ocupational disability, and the workmen's compensation and rehabilitation.

Industrial hygiene is highly significant because of its application of public health principles to industry, paralleling as it does the development of public health in municipalities, states and federal agencies which provide health protection in many forms to the citizens of numerous communities. This book represents the application of preventive medicine and public health to industry.

Adel Enlarges Plant

Adel Precision Products Corp., Burbank, Calif., announcd an expansion program to increase its present productive area by 98 per cent. Cost of land, building and equipment is estimated at $500,000.

PUBLICATIONS

The Rivnut, an internally threaded and counterbored tubular rivet, is described in a new 12-page manual just issued by The B. F. Goodrich Co. Included in the manual are instructions for applying; two pages of charts giving essential data; tables on typical ultimate strength, weights, etc.*

The Brown Instrument Co. has issued a new bulletin called **Brown New-Matic Time-Pattern Controller,** which describes in detail the operating principle of this two-unit Time-Pattern Controller; the pattern transmitter and the control instrument. Included also are diagrams and illustrations of installations.*

Allied Radio Corp., 833 W. Jackson Blvd., Chicago, has published a condensed handbook of formulas, charts and data most commonly used in the field of radio and electronics. The price of the handbook is 25 cents per copy.

Up to 30 h.p. is the title of a 4-page catalog describing the three models of Western transmissions for motorizing various cone driven machine tools, just released by Western Mfg. Co.*

Hydraulic Machinery, Inc., has just issued two new 4-page catalogs, one describing Hydraulic Power Units and the other, Hydraulic Test Units. The Power Unit section shows ten different models that are typical of what can be used in conjunction with new machines, or for change-over to Hydraulics. The Test Unit section shows a few of the models that have been recently built for checking hydraulics before and after assembly.*

Principles of Centerless Grinding, a revised edition of a treatise on centerless grinding, has been issued by Cincinnati Grinders, Inc. It deals with many technical features of interest to engineers and production men, including discussion of the following topics—basic principles, methods and advantages, work blades, wheels, examples of centerless grinding, corrective adjustment. Included is a new table of grinding wheel recommendations containing the new symbols adopted by the Grinding Wheel Manufacture Association.*

Walter Kidde & Co. has issued an illustrated 16-page manual entitled **How to Teach Fire Fighting,** which is designed to aid factory executives in instructing employees in fire-extinguishing techniques.*

A new 18-page booklet, **Pipe Templates for Welded Fittings,** has just been published by Air Reduction Co. It tells how to fabricate fittings for welded piping installations by means of flame-cutting and welding.*

A 4-page catalog describing the **Universal Slotmaster** and illustrating some of the many ways it may be used to save tools and set-ups, has just been released by Experimental Tool and Die Co.*

Kay Displays, Inc., 9 East 40th Street, New York City, has issued an attractive booklet called. **Wood, and Its Place in the War Effort.** The purpose of the book is to make known some of the manifold applications of wood and its converted forms to production problems—for war materials now and for peacetime products later.

A new catalog devoted to **South Bend 9" lathes, Models A, B and C,** has just been published by the South Bend Lathe Works. It illustrates and describes both the bench and metal column base types available in the three models.*

Eisler Engineering Co. has issued a new 4-page bulletin, #43-AT, describing and illustrating its new type economical air-cooled power and distribution transformers.*

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* Obtainable through Editorial Dept., Automotive and Aviation Industries, Chestnut and 56th Sts., Philadelphia 39. In requesting any of these publications, please give date of issue, your company connection and position.

TO MARK PROGRESS

Controlled Quality...

The Ladish Drop Forge Co. symbolizes over 41 years of continuous service to American Industry. Forward-looking scientific experts, outstanding manufacturing facilities and exacting metallurgical control have been combined to produce unexcelled, controlled-quality forgings.

LADISH DROP FORGE CO.

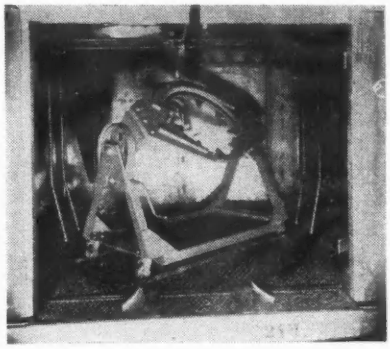
CUDAHY [MILWAUKEE SUBURB] WISCONSIN

New Products for Aircraft

Cleaning Machine for Aircraft Engines

A cabinet-type cleaning machine for aircraft engines is being offered by the Howard Engineering and Mfg. Co., Cincinnati, Ohio. Uniform and continuous cleaning is obtained by the use of a turntable designed to hold the engine and its assembly stand as it comes off the production line. The turntable revolves at 4 to 6 rpm to wash, rinse and dry an engine in about 20 minutes.

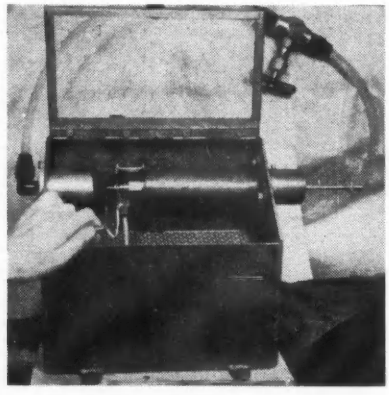
Wash and rinse solutions are applied through a set of spray pipes which extend around the engine and its stand. First wash water, then rinse water, is pumped on the engine parts, after which heated air is ejected through the blow-off nozzle to dry excess water from the engine surfaces.



Howard Cabinet Type Cleaning Machine

Machine for Cleaning Small Ball Bearings

A machine to clean and oil small ball-bearings has been placed on the market by the American Foundry Equipment Co., Michawaka, Ind. It handles bearings from ¼ in to 1¼ in outside diameter. The bearing washer consists of a solvent container, a fractional horsepower solvent pump, a solvent filter and



American Foundry Equipment Company's machine for cleaning small bearings

Haines Gages —are right!

Precision gages by Haines are synonymous with accuracy, size-permanence, fine finish and long wearing qualities—the result of thorough experience and craftsmanship.

Designed by an experienced engineering staff and made by skilled workmen in a plant thoroughly equipped with precision machinery and measuring devices, Haines Gages fulfill the exacting accuracy requirements of aircraft engine manufacturers, instrument manufacturers and producers of ordnance material.

Haines products include:

Standard A.G.D. Plug Gages—Steel or Chrome
Standard A.G.D. Ring Gages—Steel or Chrome
Special Gages—Flush Pin, Snap, Profile, etc.
Precision Devices, Tools, Jigs, Fixtures

Let us quote you on any of the above products for dependable delivery dates.

ARMY E NAVY

HAINES GAUGE COMPANY
2301 W. Allegheny Avenue, Philadelphia 32, Penna.

Traveling Light
ON THE THUNDERBOLT

Custom molded, this kick-type ventilator is tough enough for duty on Republic's P-47, America's high-climbing blitz-buster. It is another example of how lightweight Lumarith plastics, packing strength and stamina, are adding extra feet to altitude ceilings. . . . The techniques of the custom molder keep pace with aircraft and industrial design. New, knotty problems involving irregular cores, insert bracings, interchangeability, and dimensional accuracy are solved as they occur. This Lumarith ventilator is typical of the work in plastics which is being done today by the custom molder. . . . If you haven't had experience in securing molded plastic parts, here's how to get what you want: **1.** Specify to us the qualities required in your finished part: impact strength, light transmission, dielectric strength, dimensional stability. . . . We will recommend the plastic for best results. **2.** We put you in touch with the available custom molders best equipped to mold the piece by injection, compression, transfer, or extrusion. **3.** The custom molder will give you a quotation. **4.** We work with the custom molder in selecting the formulation suitable for all factors of production technique in relation to dies, heat, pressure, flow, etc. . . . Success with plastics depends upon the right plastic and the right man at the machine.

CELANESE CELLULOID CORPORATION, *The First Name in Plastics*, a division of Celanese Corporation of America, 180 Madison Avenue, New York City. *Representatives:* Dayton, Philadelphia, Cleveland, Chicago, St. Louis, Detroit, Los Angeles, Washington, D. C., Leominster, Montreal, Toronto, Ottawa.

LUMARITH*

A Celanese Plastic*

*Trade Mark Reg. U. S. Pat. Off.

the proper bearing adapters. If it is necessary on certain types of work, to remove excess solvent from the cleaned bearings, an air hose connection providing clean filtered air can be built into the unit.

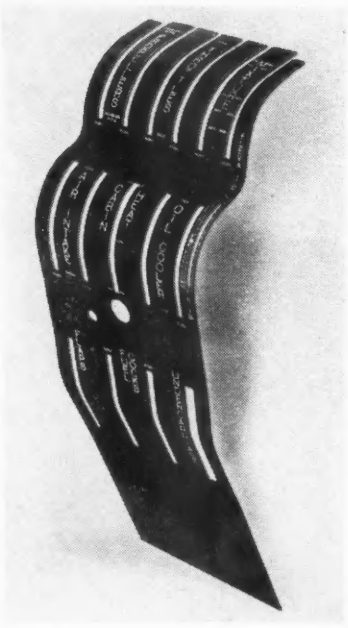
In operation, the bearing to be cleaned is placed on the adapter and injected into the spray nozzle entrance by releasing a small plunger knob. Solvent, under high pressure, is discharged from the nozzle and forced between the race and the balls of the bearing. Twirling the operating knob exposes all surfaces of the raceway to the solvent. A stripper mechanism removes the bearing after the cleaning is completed.

Curved Panels Made Without Costly Dies

An advanced technique in plastic molding makes possible fabrication of parts and panels in cylindrical shapes or simple and compound curves at low initial costs. The method used by the Theodore Moss Company, Brooklyn, N. Y., bears special application to the production of parts in small quantities where ordinarily initial costs of tools, dies or steel molds would be excessive.

Typical product of the new method is the airplane panel illustrated. The panel is accurately made to accommodate levers and knobs and conforms to multiple of curves specified by the designers. It measures 27 inches long by 7¾ inches wide and bears data in depressed white enameled letters which are conspicuous and legible due to their color contrast with the black panels. Panels of this type, heretofore made of aluminum, required a steel die to form the curves. By the new technique, the thermoplastic panels are first molded flat and, while suspended in a semi-cured state, yield to curves of an inexpensively built forming device.

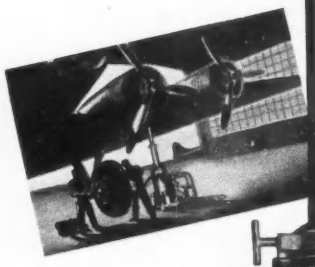
The plastic panels are considerably lighter than aluminum and incomparably lighter than other metals. The new method is said to solve cost factors in limited production for various instrument, equipment and industrial applications.



Airplane Panel made by Theodore Moss Company

GLOBE *Powered*-HYDRAULIC PORTABLE PLANE HOIST

. . . speeds production



Placed under the plane's jacking pads, these portable oil-hydraulic Hoists will raise and "flight position" big bombers or transport planes...quickly, smoothly, safely... to facilitate the attaching and adjusting of retractable landing gear and the calibrating of instruments, armor and controls . . . also to speed routine servicing operations. Hoist's wheels are compression-spring mounted, allowing entire base to engage floor or ground under load for maximum stability. Hand screw adjustment is 33¾"; power lift is 27⅝". For literature on the complete line of Globe Airplane Hoists, write Globe Hoist Co., Mermaid Lane at Queen Street, Philadelphia.

GLOBE HOIST COMPANY

Philadelphia, Pa. Des Moines, Iowa

Makers of the famous GLOBE Auto HOIST

TYPE A-70

Height when down . . . . 50 in.
Height when fully raised . 111⅛ in.
Approximate weight . . 1600 lbs.
Maximum lifting capacity, 21,000 lbs.

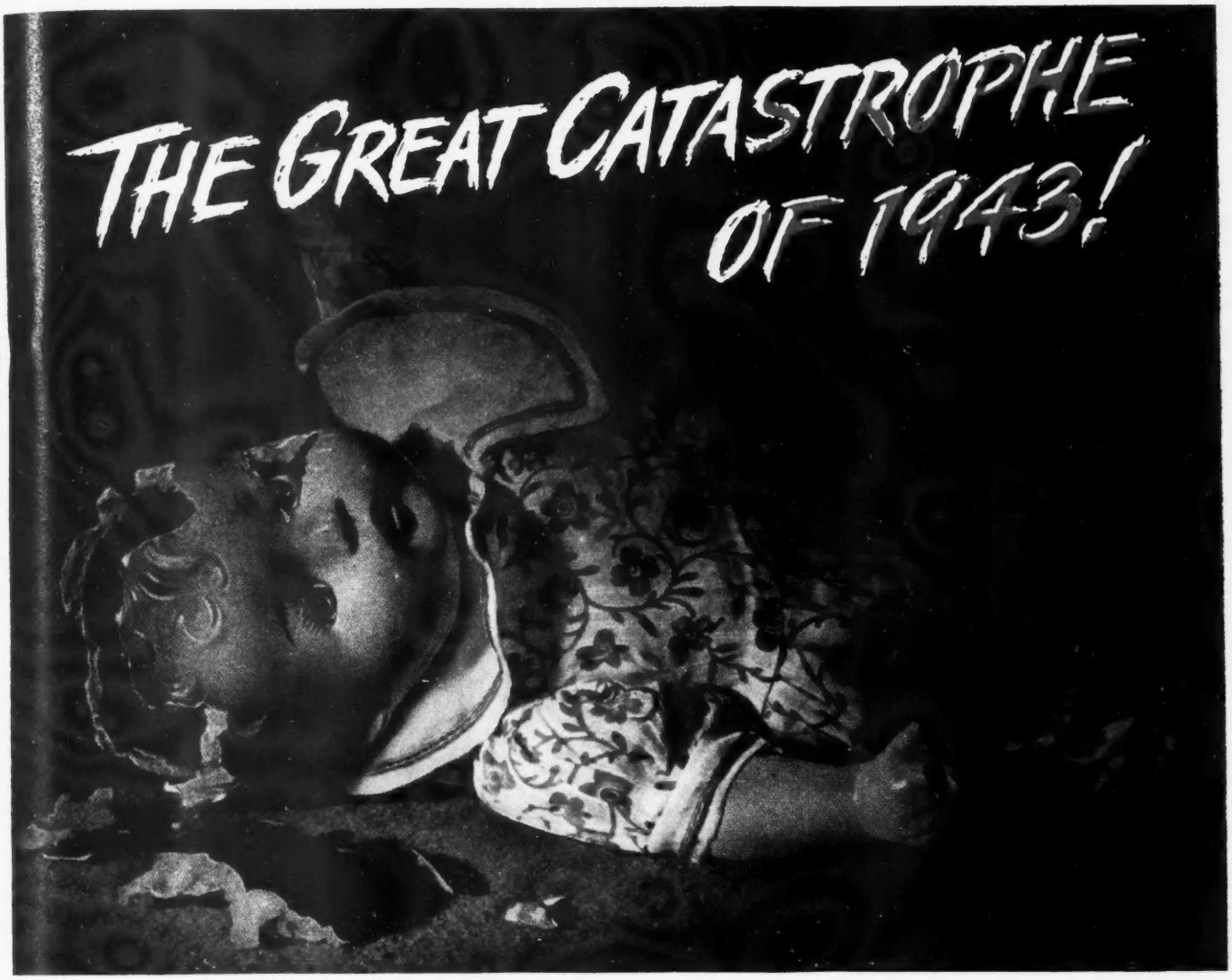
GLOBE

HYDRAULIC AIRPLANE HOISTS

Another New Wind Tunnel Being Built

A new high-pressure wind tunnel, costing more than $2,000,000, and designed to provide conditions closely approximating those encountered in all types of actual flying, is under contract for erection by the Pittsburgh-Des Moines Steel Company, and is scheduled to be completed before the end of this year.

The contract was let by the National Advisory Committee for Aeronautics, and the wind tunnel will be built on the grounds of Ames Aeronautical Laboratory, adjoining the naval air station at Moffett Field, California. Close by the site of the projected tunnel is the largest wind tunnel in the world—also under construction by Pittsburgh-Des Moines for N.A.C.A. The latter tunnel will cost more than $5,000,000 when completed.



"It was exactly ten o'clock. I know, because I'm sittin' there with my brother-in-law and his wife, and they just got through sayin' it's ten o'clock and they better get home, when suddenly the lights go out. 'That's funny,' I says. 'Yeah, must be something the matter,' my brother-in-law says, 'call 'em up and ast 'em.' So I'm huntin' for the phone, and nearly break my neck when I step on the kid's doll, and then I pick up the phone and there don't nobody answer."

With some such homespun speech as this would many an American commence his version of the Great Catastrophe of 1943 — if by some freak of natural phenomena every electric line in the country should suddenly go dead.

Imagine, if you can, this entire nation without electricity, barely 70 years after the first electric lines appeared. "Brother, I want to tell you that was one hell of a mess," the sidewalk historian would go on to say. And he'd tell how industry, without power for its electric machines, stopped dead. How transportation got tangled, and all communications were out. How food began to spoil, and fuel supplies dwindled, and cities were without water. And how ignorance and fear fanned the growing national panic as the dread spectres, Crime, Famine and Disease swept over the land.

Preposterous? Certainly. Yet we can think of no more graphic way of illustrating our national dependence today upon the electrical industry. And that entire industry — with its countless products and blessings — was made possible by a relatively few basic precision machine tools!

Jones & Lamson was in at the very birth of the Electrical Age in America, and literally millions of different parts, products and machines have stemmed from machine tools designed and developed by this one company.

In the swiftly changing world of today, such a background as this is of great value to American industry. For it means that Jones & Lamson engineers and service men are among the best qualified machine tool specialists in America to assist your own engineers in meeting changing production problems. Call upon them!

Universal Turret Lathes ▪ Fay Automatic Lathes ▪ Automatic Thread Grinders ▪ Optical Comparators ▪ Automatic Opening Die Heads

JONES & LAMSON MACHINE CO., SPRINGFIELD, VERMONT, U.S.A.

Profit-producing Machine Tools

Qualifications of a Good Safety Administrator

The first requisite of success is curiosity; intellectual curiosity. If a safety man has that you can start looking for his other good qualities. If he hasn't, you'd better start looking for another man. By intellectual curiosity I mean the sort that never gets enough answers, that never tires of asking how this process works and why, how that machine works and who invented it and how can it be improved or made safer and how will this man or that react in any given situation and why.

Processes, machines and materials are constantly changing and the safety problem changes with them. One of the fundamental challenges of this job, the never ceasing question, is—how does a man injure himself with tools and machines that he has used for years, that he understands better than the safety man ever will? Why didn't he see, hear, feel and think about the things he should have seen, heard, felt and thought about to save himself from injury? How are you going to make sure that the next man does see, hear, feel and think well enough to prevent a similar injury?

Curiosity on this job means mostly curiosity about people. Our ideal safety man will need to know something about machines and processes and protective devices, but mostly he needs to know about people—how they'll react to words and attitudes and situations.

Goggles are no good unless a man believes he should wear them and does wear them. Guards are no good unless machine operators keep them in place while the machine is running. It's more important to teach men *why* than *how* because if they know *why* they can usually figure out *how* or at least they will accept the how when you supply it. Before your teaching will reach them, however, your curiosity must have found out what makes them tick.

Curiosity about people usually springs from a liking for them and it's important that the safety man have that too. We have both met the safety man who is a great "company man" and who takes the attitude that the men are always wrong, that they are injured as a result of cussedness, idiocy and a desire for compensation. I have two quarrels with that attitude. In the first place I honestly believe that what helps business helps the worker and that what helps the worker helps business, and therefore I can never believe that all the right is on either side. Second, and more important, the attitude I mentioned just plain doesn't solve the problem. It doesn't even come close to getting at the fundamental cause of an industrial injury. It's unscientific and it's lazy. It's an answer compounded of the kind of thinking that prompted the old lawyer to tell the young one who was just starting in practice, "Son, when the facts are on your side, argue the facts. When the law is on your side, argue the law. When the facts and law are both against you, give the other side hell!" Explaining an accident as cussedness is merely giving the other side hell without even investigating the facts or the law.

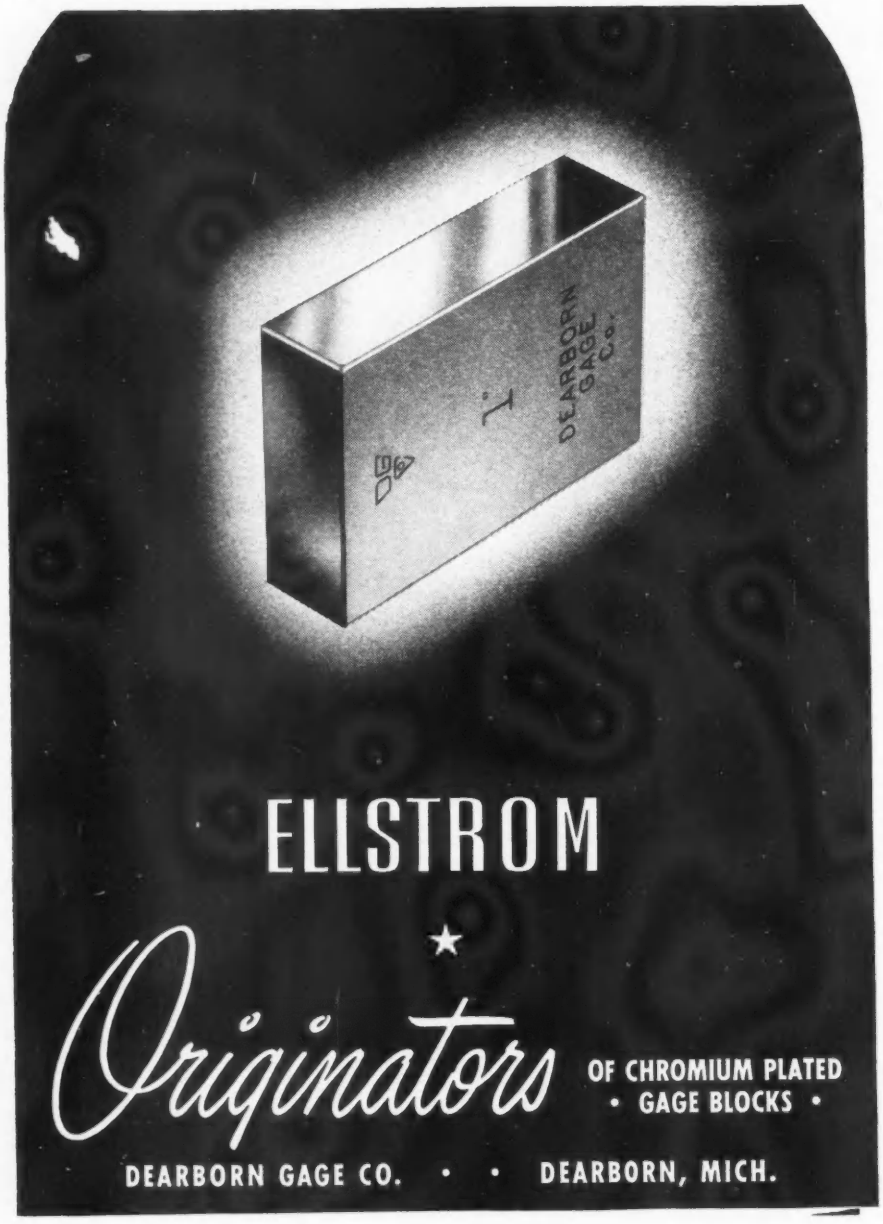
Aggressiveness—Responsibility

Suppose we've found a man who is possessed of intellectual curiosity and who has an interest in and liking for people. What other traits of character should he have? I'd say aggressiveness; persistence with tact. When his curiosity has turned up a problem and found an answer to it he's going to have to be able to sell that answer to the boss, prove that it will do the job and that it is worth the cost. That doesn't mean that he can write his boss a memo outlining the problem and his

This article is an abstract of a paper presented at the 31st National Safety Congress by Roy L. Rollins, Director, Safety and Plant Protection, A. E. Staley Mfg. Co.

(*Turn to page* 144, *please*)

★ FOR THOSE WHO WANT THE FINEST ★



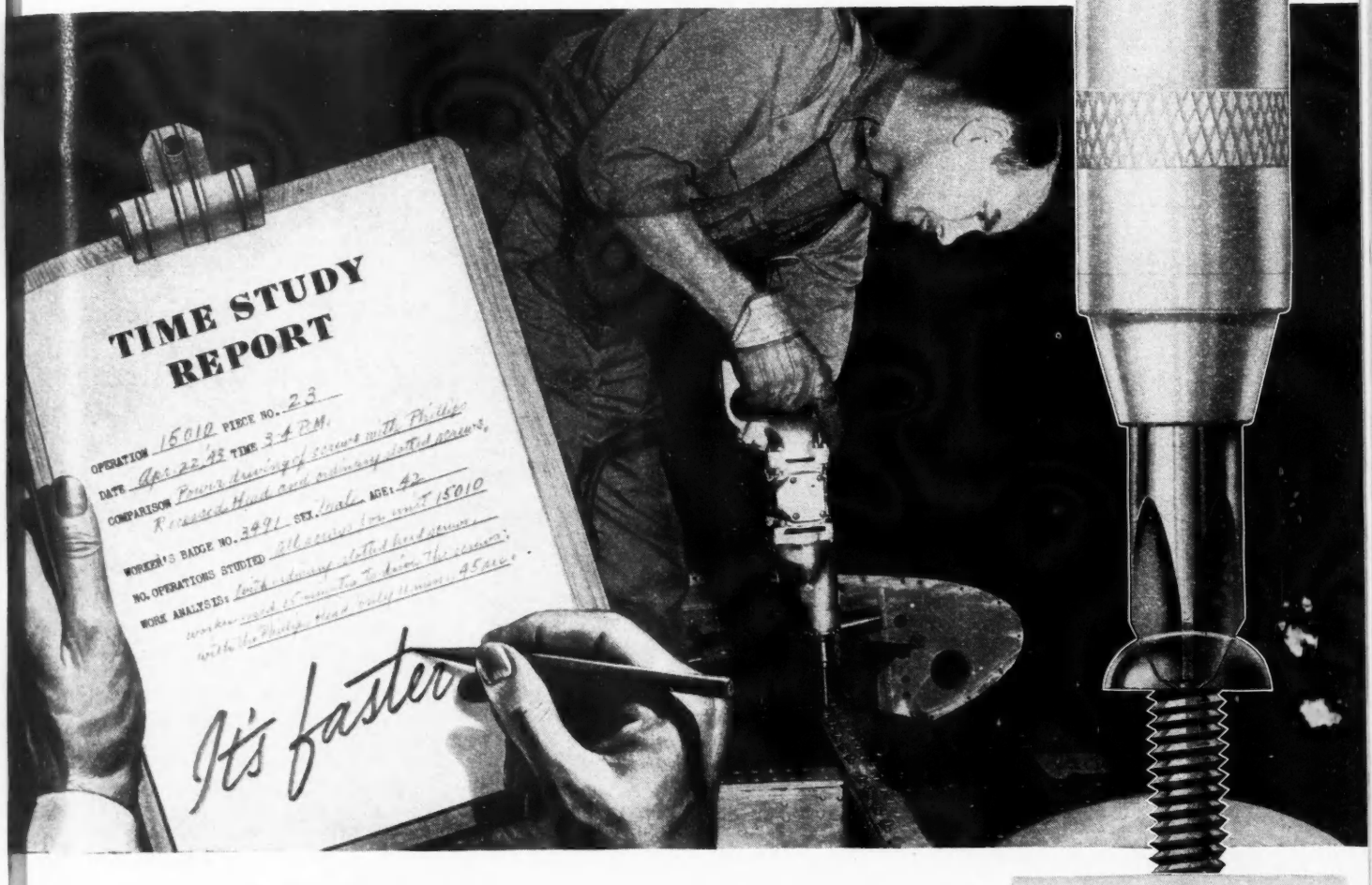
ELLSTROM

★

Originators OF CHROMIUM PLATED • GAGE BLOCKS •

DEARBORN GAGE CO. • • DEARBORN, MICH.

Arm Your Screw Driving Army for SPEED TACTICS


TIME STUDY REPORT
OPERATION 15010 PIECE NO. 23
DATE Apr. 22 '43 TIME 3:4 P.M.
COMPARISON Power driving of screws with Phillips Recessed Head and ordinary slotted screws.
WORKER'S BADGE NO. 3491 SEX. Male AGE 42
NO. OPERATIONS STUDIED 50 each ordinary slotted head screws
WORK ANALYSIS: Each ordinary slotted head screw worker used 45 seconds to drive. The screws with the Phillips head only 11 secs. 45 secs.
It's faster

SPEED-UP WITH PHILLIPS SCREWS!

Give your assembly line Phillips Recessed Head Screws and you'll give them the ammunition to clean up lagging assembly jobs on the double-quick!

In most cases, change-overs to Phillips Screws have cut driving time in half! All of the screw driving troubles that slow-up work are eliminated by the Phillips Recessed Head. The scientific recess, by automatically centering the driving force, prevents fumbling, wobbly starts . . . prevents slant-driven screws . . . burred and broken screw heads . . . dangerous screw driver skids.

The Phillips Recess lends "old-hand" skill to the newest newcomer . . . makes fast, faultless driving automatic. It permits power or spiral driving on almost any job.

They cost less to use! Compare the cost of *driving* Phillips with that of slotted head screws. You'll realize that the price of screws is a minor item in your total fastening expense . . . that it actually costs less to have the many advantages of the Phillips Recess!

KEY TO FASTENING SPEED AND ECONOMY

The Phillips Recessed Head was scientifically engineered to afford:

Fast Starting – Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

Faster Driving – Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

Easier Driving – Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

Better Fastenings – Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS SELF-TAPPING SCREWS • STOVE BOLTS

21 SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

Production Illustrations

(*Continued from page* 31)

the production line inspection sequence. Breaking down inspection into single-operation procedure not only promotes facility in handling each operation, but savings in total man-hours required for inspection. It also results in large savings in inspection equipment costs, for under this system, an inspector usually needs only one or two instruments or gages but uses them almost continuously. Under the old system, each inspector made a series of inspections on each unit, thereby tying up several gages and instruments for his personal use.

Burring and Cleaning are operations that must be performed on most manufactured parts because milling, drilling, boring, counter-sinking, etc., leave sharp or ragged edges of metal which must usually be removed before any other operations are performed, or during the final finishing. Precision metal parts in particular are very critical in these respects, and must be carefully handled, finished, and assembled. With these things in mind, the Burring Illustration drawings have been made. Fig. 3 (P. I. drawing P-5046-2) is a partial illustration of burring procedure. When gathering data for the illustrations, the illustrator who makes such drawings refers to the Manufacturing Method or Route sheets, the leadmen and mechanics on the particular job, and to the Tool and Engineering departments.

Because of the complexities of the manufacturing procedures required in making precision products, all along the route from raw stock to the packaged product, and because of the scarcity of experienced operators, it is necessary to add certain information to the engineering drawings and route sheets which accompany each shop order. The need would still exist even with experienced operators, to secure uniformity of procedures and, consequently, of product. The old Chinese proverb that "One picture is worth ten thousand words" well states the basis upon which the pictorial method of supplying this shop information is founded, and experience has shown that its use results in better and greater output even by experienced operators, thus reducing spoilage and lowering the unit cost of production.

These Fabrication Job Illustrations, as they are called, indicate the proper set-ups throughout the manufacturing processes. An example is shown in Fig. 4 (P.I. drawing P-5043-3); it shows how basic information may be so placed before the individual operator that he cannot mistake the requirements set up therein. Note again that this illustration is definitely intended to supplement the engineering drawings and the route sheets, that the proper usage of the required tools is indicated. Finished part handling notes are also included as a means of cutting down spoilage caused by careless handling.

Assembly Job Illustrations. It is evident that there can be but *one* proper manner of assembly and it is desirable that this be brought forcibly to the attention of the assemblers. For an example, see Fig. 5 (P.I. drawing P-5010-4), on which the assembly operations are shown in sequence. Note also that attention is called to the necessity for special care in handling fragile parts or fine finishes, such as seals, threads, super-finished areas, etc.

Because, in many cases, the proper fabrication, finishing, inspection, assembly and adjustment of small precision parts cannot be accomplished satisfactorily without magnification, suitable "blow-up" views are shown, depicting the part as it appears when seen through the lens. Thus the assemblers and inspectors may be shown what to check for under such conditions. Without these illustrations there could be no uniformity, for what one worker might consider a good and proper condition, another might think poor workmanship. With illustrations available showing the areas under inspection in actual scale relationship it

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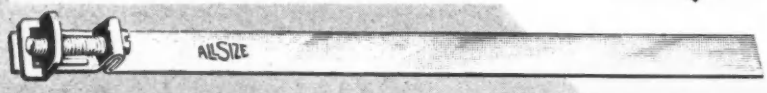
ONE SIZE FITS WIDE RANGE OF HOSE DIAMETERS

Costs Less!
Easiest To Use!
100% Self-Locking!

INVESTIGATE the superior advantages of this powerful, approved and *completely universal* hose clamp. A single length actually replaces more than 100 different preformed clamp sizes . . . eliminating your production bottle neck . . . reducing your clamp inventory . . . assuring right size clamp on hand when needed. Ideal for both service and production work. Has maximum take-up, and can be installed around or removed from connected lines. Comes packed flat in any length to fit any desired range of diameter sizes.
Send today for Free Sample and Prices on over-all lengths you require.

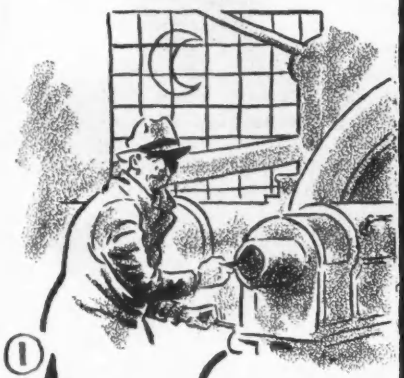
Standard Equipment for Army and Navy Trucks, Tanks, Jeeps, Aircraft, Half-Tracks, Amphibians, Cranes, Marine Engines, Road Rollers, Farm Machinery, Portable Saws, Searchlights . . . All Types of Radiator Hose . . . Diesel and Gasoline Motors.



CENTRAL EQUIPMENT CO.
1018 South Wabash Avenue Chicago, Illinois

WHAT UTAH PARTS ARE USED HERE?

(ANSWERS AT BOTTOM OF PAGE)



① **ALARM SYSTEMS**

SABOTEURS AND OTHER MARAUDERS ARE STOPPED IN THEIR TRACKS BY INCORRUPTIBLE MECHANICAL GUARDIANS THAT NEVER SLEEP. A UTAH PART HELPS MAKE THEIR NON-FAILING PERFORMANCE POSSIBLE.

② **POWER-DRIVEN MACHINE GUN AIRCRAFT TURRET**

LIKE THE TWO-GUN MAN OF FRONTIER DAYS, THIS GUNNER HAS HIS WEAPONS READY TO SPIT FIRE IN A SPLIT-SECOND···NO MATTER FROM WHICH DIRECTION THE ENEMY MAY ATTACK. A UTAH PART PLAYS A VITAL ROLE.

③ **ELECTRIC FANS**

COOL THE SWEATING BROW OF THE WAR WORKER IN HIS HOME··· INVIGORATE THE WEARY SOLDIER OFF DUTY. UTAH PARTS PROVIDE DEPENDABILITY AND LONG LIFE.

THESE ARE ONLY A FEW OF THE MANY PRODUCTS NOW USING PARTS MADE BY UTAH. YOUR PRODUCT, TOO, CAN PROBABLY BENEFIT FROM UTAH'S EXTENSIVE EXPERIENCE IN SOLVING WARTIME ELECTRICAL PROBLEMS. UTAH MAKES A WIDE LINE OF PRODUCTS FOR ELECTRICAL AND ELECTRONIC DEVICES. WRITE US TODAY FOR FULL INFORMATION — GET THE FACTS BEHIND UTAH'S PRECISION MANUFACTURING AND ADVANCED ENGINEERING AND SEE HOW THEY CAN BENEFIT YOUR PRODUCT.

UTAH RADIO PRODUCTS COMPANY, 859 Orleans Street, Chicago, Illinois • Canadian Office: 560 King Street, West, Toronto
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RESISTORS ③ POTENTIOMETERS, RESISTORS, HEADSETS ② RESISTORS, RHEOSTATS ①

becomes possible to make comparisons with the appearance of the actual part under consideration, and to work to definite standards. This further promotes uniform and satisfactory fabrication and assembly; indeed, in the case of microscopic tolerances and super-finishes, satisfactory results would be almost or quite impossible without such standards of comparison.

With these blow-up views are given notes calling attention to defects in material or workmanship, usually visible only under the glass, which would cause rework or scrapping of the part, such as nicks on valve seats, pores in machined surfaces of castings, rough sealing areas, etc. Again, all affected engineering drawings are referenced.

The results of using this type of illustration in the assembly department are very good, inasmuch as they outline the assembly procedure, step by step, for all operators, thereby assuring substantially identical results from all operators on like operations. Another advantage is that if the procedure is followed as outlined, the solution of any problem encountered and the revised procedure illustrated will be equally useful for all other operators, and will remove the necessity for them to lose time in questioning their leadmen.

A workman will often commence a complicated assembly during the latter part of his shift. Without P.I., the worker who takes up the work in the next shift must first check over all that has been done in order to determine where his own work starts. With P.I. installed on the job, he can tell at a glance where to begin and the exact method required. The inspector who checks the assembly will know that even though more than one operator has been involved in the work, the normal, standard procedure has been followed throughout.

It is well known that in many factories operating two or more shifts, as many different characters of product result because, when working only from blueprints and the verbal instructions of those who determine the interpretation of them—superintendents, foremen and leadmen, differences in opinion invariably affect the work of the shop. Where production illustration is used such a condition is hardly possible.

In the training of new and inexperienced workers it has been the general custom to base the instruction upon the blueprints, thus attempting to teach something of the difficult art of blueprint reading while also trying to make the beginners familiar with shop methods and products. The fallacy of this attempt is that in many cases the workers in the shop rarely or never see all the prints, and are therefore prone to improvise procedures. In contrast, the use of P.I. drawings and route sheets, together with the engineering drawings, has proven very effective in the training program of the Adel Precision Products Corp. A knowledge of blueprint reading sufficient for the individual job is acquired, more or less incidentally, while learning the work from the illustrations and route sheets. Best of all, no wrong or improvised methods are acquired, and the standard, uniform, proven practices of the factory become the accepted methods of all workers. By such means *only* can efficient production of a uniform quality of precision products be obtained.

A New Puller

A new Bearing and Battery Terminal Puller, known as Steelgrip No. 13 and No. 13A, which has just been brought out by Armstrong-

Bray & Co., Chicago, Ill. The arms are drop-forged, heat-treated steel, with long, thin hooks. The puller is made in two sizes, the smaller having a 2 inch reach, and the larger having a reach of 5 inches.

This way

TO BETTER TOMORROWS

By building better for war, American Industry is learning how to build still better for peace. Out of mammoth production of efficient engines and tools of destruction, will come new safety and comfort, new conveniences and economy for secure and happy living . . . Aetna's own experience is typical. We have made Precision Bearings by the millions—for implements of war. Out of intense ceaseless effort to build better and faster, have come new techniques and methods, new short-cuts and savings. We have built not only bigger bearings, but better ones. We've applied them to new uses. We've found how to make them efficiently, faster and at a lower cost. . . . How these new and better ways can be practically applied to your own pleasant peace-time activities is a subject we'll enjoy exploring with you — when you are ready. Aetna Ball Bearing Manufacturing Company, 4600 Schubert Avenue, Chicago, Ill.

In Detroit: SAM T. KELLER, 7310 Woodward Avenue. Phone Madison 8840-1-2.

Aetna BALL BEARINGS

THRUST (STANDARD AND SPECIAL) AND ANGULAR CONTACT BALL BEARINGS
ROLLER BEARINGS (SPECIAL) BALL RETAINERS HARDENED AND GROUND WASHERS

Gear Set Production For Medium Tanks

(*Continued from page 27*)

the hub and hub face are ground on a Norton grinder with a 45 deg angular head. The bore is ground on a No. 75 Heald internal grinder. The blank then returns to the gear lab for a repetition of checking as in the green, followed by corrective lapping if necessary.

Shifting the scene from strictly gear operations, we have selected one of the large shafts as typical of a sampling of other metal cutting activities. This example is the output shaft, a forging requiring some 45 operations for completion.

Prior to machining, the forging is inspected, straightened on a 50-ton Oilgear press. A 6 x 60 in. Sundstrand double-end milling and centering machine is used for milling ends to length and centering. The long and short ends of the shaft are turned in separate settings in 8 x 36 in. Lo-Swing lathes. The shaft is straightened again, then gun-drilled on a W. F. & John Barnes single end deep hole drilling machine, producing a hole 7/8 in. in diameter, 24¼ in. deep, followed by centering and drilling of oil holes.

Green grinding of one diameter is handled by a 10 x 36 in. Landis plain grinder, green grinding of a series of diameters is done on a 10 x 36 Cincinnati grinder. The shaft is re-centered on a 7 x 17 in. LeBlond heavy duty Rapid Production lathe. Five splined key-seats are end-milled on a Natco Duplex spline mill; four keyways are milled on a No. 2-24 Cincinnati plain automatic milling machine. Splines on the long end are hobbed on a Model 7 Lees-Bradner; and involute splines on the short end are hobbed on a similar machines.

The shaft is burred, washed, completely checked in the gage lab, and proceeds to heat treat where the work is packed in 44½ in. tubes for carburizing. It is hardened, straightened, drawn, inspected and cleaned, and returned to the machine shop.

Next follow ten separate operations of grinding individual diameters over a battery of 10 x 36 in. Cincinnati plain hydraulic grinders. The threads on both ends are precision ground on Ex-Cell-O thread grinders. Final inspection completes the routing.

For a rather distinctive example of machine shop practice consider the synchronizing clutch gear, appropriately dubbed the "dog-collar" by the shop people. Major machining operations of boring, turning, facing, etc., are handled on Bullard Mult-Au-Matics, rough- and semi-finish on a 12 in., 6-spindle Bullard; finish-machining on an 8 in., 6-spindle Bullard.

A 25-ton American vertical broaching machine is used for broaching internal teeth, using a pull-type broach.

Perhaps one of the most impressive features of the dog-collar is the grinding of the four trunnions, each one be-

The war production requirements for precision in every mass produced unit of assembly are amply met by HOLTITE Screws, Bolts, Nuts and allied fastenings. Produced in great quantity with the uniform precision of small tools, these trouble-free units are gauged and inspected to strict standards of accuracy throughout every stage of manufacture. From metallurgically tested raw materials, through the wire processing mill (in our own plant), to final inspection, HOLTITE fastenings are fabricated by the most precise equipment in the industry.

Precision parts effect time-saving, reduce spoilage, and assure enduring, faultless service. Specify HOLTITE on your next order.

HOLTITE Recessed Head Screws & Bolts ➡

Cutting driving time an average of 50%, these production-boosting screws and bolts can be driven ***safely*** by spiral, electric and pneumatic drivers without danger of injury to material or worker.

CONTINENTAL SCREW CO. New Bedford, Mass., U.S.A.

BUY MORE WAR BONDS

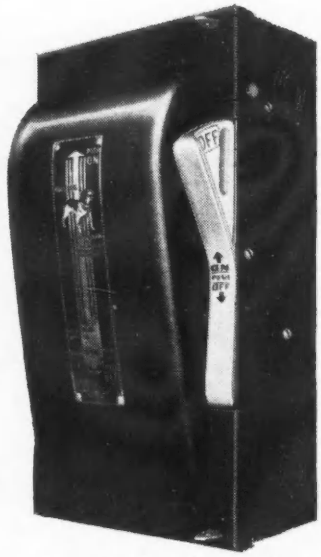
ON PUSH OFF

HOT ARCS STOPPED COLD!

BullDog's Vacu-Break Safety Switch with "Clampmatic" Contacts provides the faster, tighter closing — and quicker, smoother opening — needed for safest, most dependable operation at lowest maintenance cost.

ON "Clampmatic" switch contacts exert a wedging action when engaged with the beveled ends of the stationary contact prongs. This wedging action puts great pressure on the movable slug, for positive pressure contact in ON position.

OFF When the handle is pushed to OFF position, the static energy stored in clamp spring helps make an easier, smoother separation of contacts. This quick-break operation in the close-fitting arc chamber creates a MAGNETIC BLOW-OUT effect which quickly dissipates arcing.



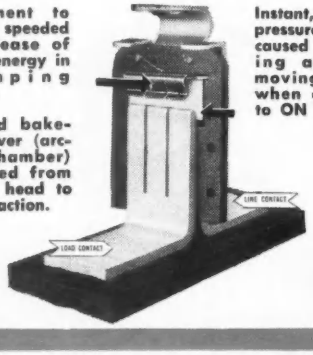
Streamlined, push type, front-operated rocker handle *inside* cabinet lines.

BULLDOG *Vacu-Break* SAFETY SWITCH

with "Clampmatic" Contacts and front-operated Rocker Handle.

Movement to OFF is speeded by release of static energy in clamping spring.

Formed bakelite cover (arcing chamber) removed from switch head to show action.



Instant, positive pressure contact caused by wedging action of moving contact when operating to ON position.

Full ON position. Moving contact now fits tightly between stationary Line and Load contacts under full clamping pressure of the spring.

BULLDOG
ELECTRIC PRODUCTS CO.
Detroit, Michigan

BullDog Electric Products of Canada, Ltd., Toronto, Ontario

Field Engineering Offices in All Principal Cities

MANUFACTURERS OF Vacu-Break Safety Switches, SafToFuse Panelboards, Circuit Master Breakers, Switchboards, Bus Duct Systems— FOR LIGHT AND POWER.

BUY MORE WAR BONDS

ing finished to octagonal form, after suitable preparation in the green by surface broaching. At the outset the operation was performed in individual steps for each side of the octagon on each of the four trunnions—a costly, time-consuming job. Today the job is being done rapidly and automatically on 10 x 36 Norton cylindrical grinders fitted with special Ohio Units cam grinding attachments. This attachment automatically indexes the trunnion through eight successive steps, taking one trunnion at a time.

This word picture of the manufacture of a few of the major parts, as given above, is supplemented by a pictorial presentation which provides a better impression of the general character of the equipment not only in the gear department but in the case department as well.

It may be noted in passing that tooling plays a major role in the operation of a metal cutting establishment of this kind. At the present time most of the tooling in the gear department is of H-S-S type, with some examples of Stellite and some Carboloy. It is important to note that the diamond represents one of the major items of tooling here due to the great variety of precision grinding and thread grinding equipment. Here the diamond is employed primarily for dressing the grinding wheels. But it must be remembered that automatic precision grinding operations depend entirely upon the dressing tool for the maintenance of wheel conditions and wheel dimensions which are so vital to quality control.

Finally, it is important to repeat that the Buick transmission operation is actually a coordination of engineering, metallurgical control, quality control, and machine shop practice—all inter-related, and all dove-tailing to make the job a success.

New Goodyear Research Laboratory

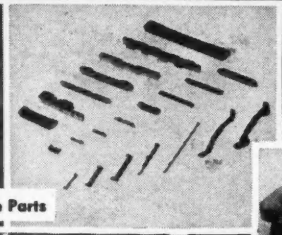
The new Goodyear Research Laboratory in Akron, Ohio, gives scientists and engineers of the Research Division of the Goodyear Tire & Rubber Co. some of the finest facilities in the world for scientific investigation.

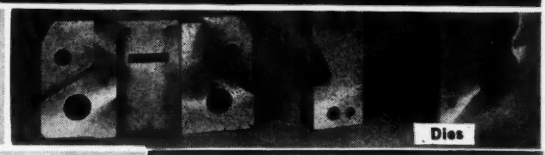
Built and equipped at a cost of $1,325,000, the new laboratory contains the latest instruments available for research in rubber, synthetic rubber, plastics, aircraft, and allied fields.

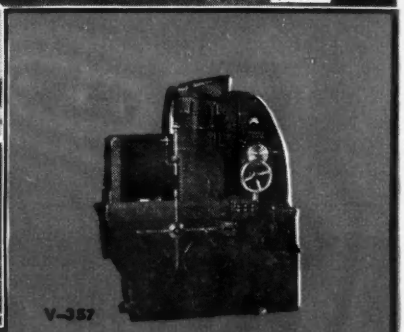
The present research personnel of the Goodyear Research Division consists of approximately 125 chemists, physicists, engineers, and metallurgists, along with some 400 others who spend full time on field work.

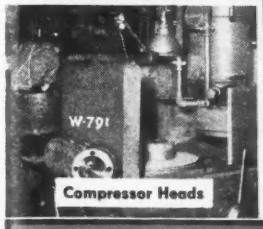
The new laboratory, when all its equipment is installed, will accommodate double that number of scientists with necessary clerical and other assistants.

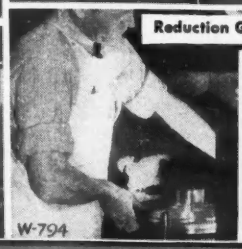
"PUT IT ON THE BLANCHARD"



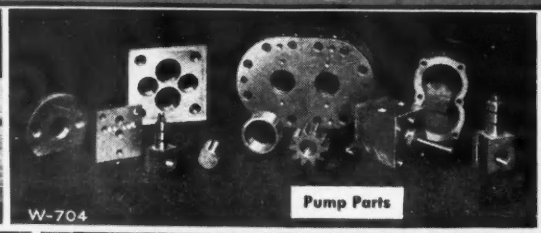


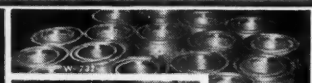


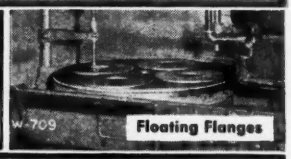


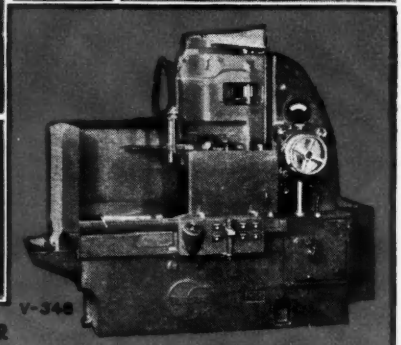


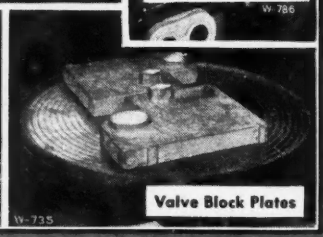
EXAMPLES OF WORK DONE ON THE NO. 11 BLANCHARD SURFACE GRINDER



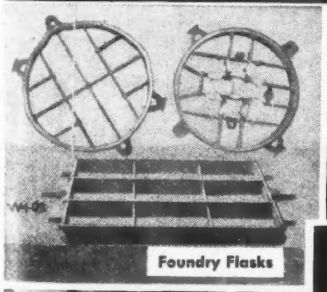


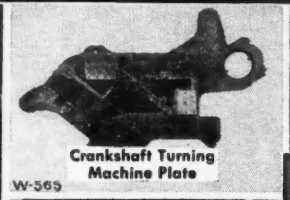


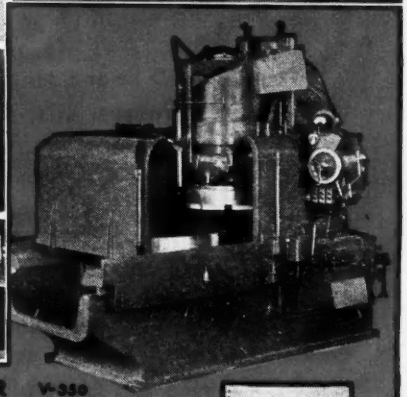


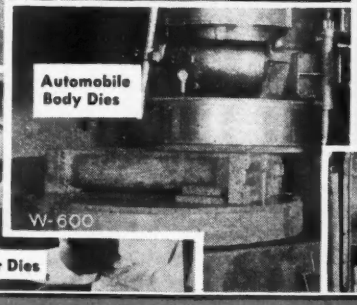


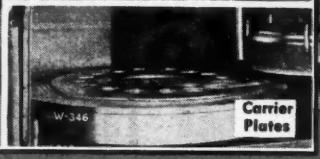
EXAMPLES OF WORK DONE ON THE NO. 18 BLANCHARD SURFACE GRINDER











EXAMPLES OF WORK DONE ON THE NO. 27 BLANCHARD SURFACE GRINDER

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE, MASS., U. S. A.

SEND FOR THIS WORK BOOK

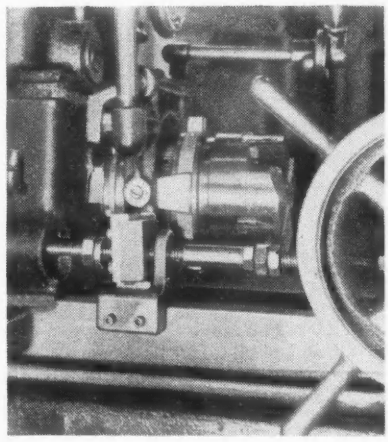
New Production Equipment

(*Continued from page* 38)

units can be supplied with either a motor or a hand wheel for tilting.

A MECHANISM for opening the 7V Lanco die head instantaneously has been designed by the Landis Machine Company, Waynesboro, Pa. It is said to eliminate the effect of carriage travel, ordinarily required to open the die head, on close tolerance threads.

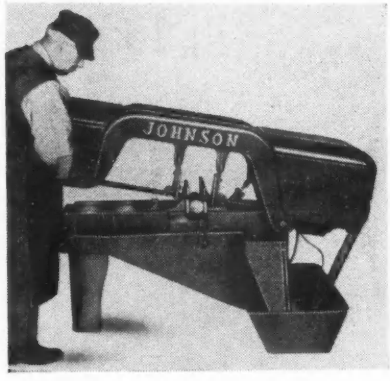
The Landis quick opening mechanism comprises a spring in combination with a latch and latch block arrangement in addition to the conventional yoke employed to open and close the head. In operation the yoke is employed to close and latch the head within itself. When the head is in the closed position, the yoke also locks independently of the Die Head. As the yoke closes the head, spring tension is built up in an extension spring, one end of which is anchored to the machine bed and the other end of which is attached to the yoke. As the threading operation progresses to the point where the Die Head is to be opened, a sleeve on the trip rod raises the latch from the latch block, thus releasing the yoke and permitting it to snap back quickly causing the head to open instantaneously.



Landis quick opening mechanism for Lanco die heads.

The Landis quick opening mechanism is adjustable for threads of different lengths by moving the latch operating sleeve on the trip rod and by moving the latch block bracket along the ways of the machine. Means are also provided to adjust the tension of the spring.

THE Johnson Wet Cutting Model Metal Saw has been developed by the Johnson Manufacturing Corp., Albion, Mich. for ultra high-speed cutting. The piston type pump is mounted in the frame and is driven by a noiseless cam. As the pump is driven from the saw drive gear, its speed is automatically regulated by the speed of the machine, and flow of coolant is in direct relation to blade speed. If dry cutting is desired, pump may be readily disconnected. Johnson Saws now in use may be equipped with this coolant feature, the installation requires approximately 45 minutes.



Johnson Wet Cutting Model Saw

A MOTOR-DRIVEN pipe and rod carrier which permits a cab operator to pick up 1500 lbs of stock in 12 ft

WROT FITTINGS BY NIBCO

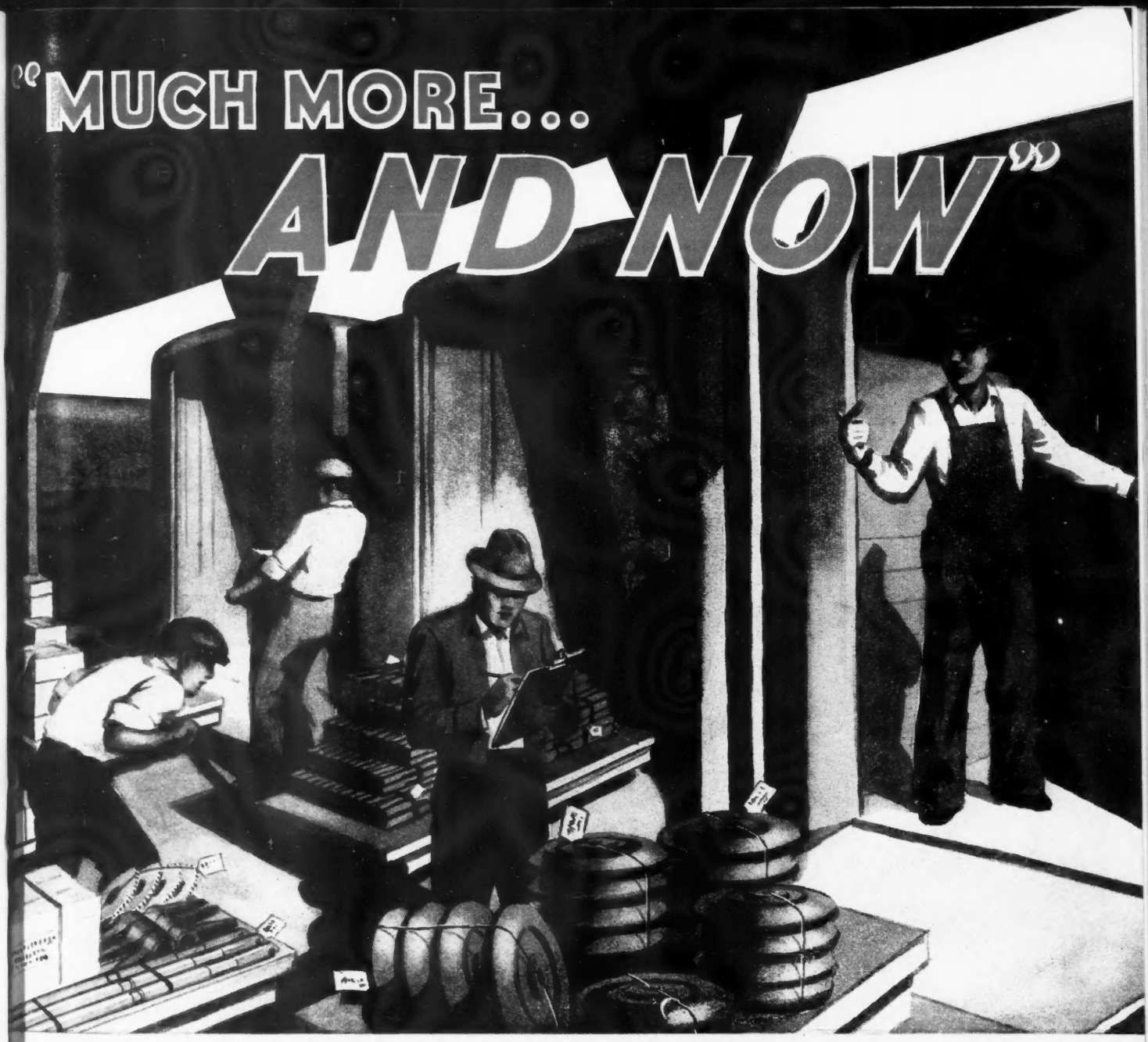
EXTRUDED FROM A SINGLE STRAIGHT TUBE

AN *Engineering Miracle!*

FORMED in one step from a straight tube . . . NIBCO WROT tees, crosses, ells, and return bends are marvels of engineering development. Every one is perfectly formed . . . absolutely "round and square" . . . uniform in thickness and strength. The same engineering genius which made this possible is at work today developing new products and time-saving processes for war. NIBCO valves and fittings will have their share in winning it. But in the new day that is to come . . . you'll need us and we'll need you. Remember NIBCO service . . . from blueprint to packaged product . . . made right . . . delivered on time.

NORTHERN INDIANA BRASS CO.
ELKHART, INDIANA
VALVES AND FITTINGS SINCE 1904

"MUCH MORE... AND NOW"



No longer is there any apprehension that America's air war effort might be a matter of "Too little and too late." American industry's answer is being given by American planes, in every part of the world where the enemy shows a wing.

Our nation's record-shattering aircraft building program called for unprecedented quantities of many items, including thousands of tough, drop forged parts to withstand the impacts and stresses of prolonged flight and combat.

To answer this particular call, the modern plant of the Kropp Forge Aviation Company was built. It is dedicated to the exclusive production of drop forged "airframe," landing gear, wing and engine parts. Today this new plant is turning out an almost unbelievable volume of drop forgings of every type required by aircraft builders.

Much more—and now, is our watchword. Deliveries are being made on schedule, without curtailment of our usual rigid laboratory control of production and the thorough inspection every aircraft forging undergoes.

The inquiries of plane and engine builders for forgings of all types are solicited. Prompt delivery assured.

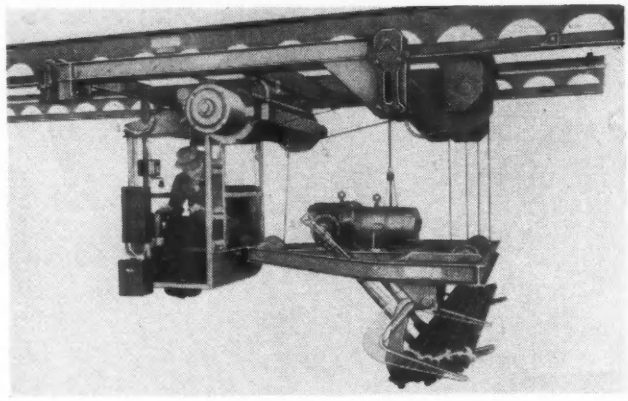
Member of the A.C.C.A.

Kropp Forge Aviation Co.

5301 W. ROOSEVELT ROAD CHICAGO

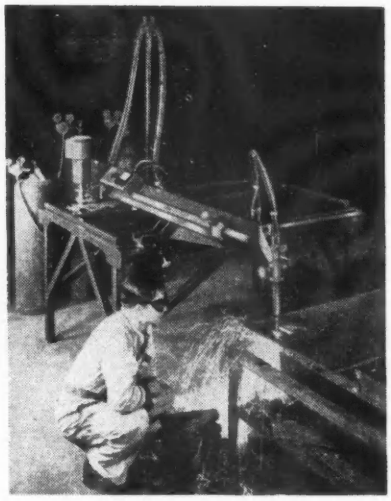
Engineering Representatives in Principal Cities

lengths, transport it, and set it in racks at fabricating machines, is a recent development of The Cleveland Crane & Engineering Company, Wickliffe, Ohio. The pick-up fork assembly has a 3-point rope suspension from the carrier which gives it the necessary rigidity for handling loads that are out of balance. The double overhead track system provides stability and minimizes swing. Rod and pipe are handled by two forks which are tilted upward when loading, or downward when unloading, by a motor driven crank. A limit switch automatically stops the forks in the upward or holding position when the fork mechanism is not in operation.



Cleveland motor-driven pipe and rod carrier

THE National Type JR Shape Cutting Machine is the latest addition to the line of shape cutting machines being offered by the National Cylinder Gas Company, Chicago, Ill. It is designed to handle all cutting jobs from the smallest up to an overall size of 3 ft by 4 ft. A hand wheel provides micrometer adjustment of the torch in relation to the end of the carriage, making it unnecessary to place the plate to the exact position on the table. A calibrated indicator provides for quick, accurate setting of the torch to any desired angle. All controls are placed so that they may be operated from the front of the machine or from the aisle between the work and the cutting table.



National Type JI Shape Cutting Machine

THE M. E. Cunningham Company, Pittsburgh, Pa., is marketing a Safety Sleeve Holder designed for marking small, round and square pieces.

The Safety Sleeve Holder is said to be especially adaptable for marking gun barrels, small tubes and also for numbering stock in warehouses or stock rooms. The outside frame is made from alloy steel and the legs of the frame are grooved for use on small rounds.

The top section, surrounding shank of type holder, is knurled for positive grip, and a special pin, easily removed

WITH STROM STEEL BALLS

In America's vast war production program Strom steps up its untiring energies to the mastery of one thing For over a quarter century Strom has concentrated on Metal Balls. Today, through a series of lapping operations, Strom Balls possess a degree of surface smoothness and sphericity that is unequalled in any other regular grade of ball

Correct hardness, physical soundness and size accuracy in all Strom Balls is assurance of More Bearing Mileage. For longer trouble-free bearing life specify Strom Metal Balls in ALL ball bearings

Largest independent and exclusive Metal Ball Manufacturer

Strom STEEL BALL CO.
1850 South 54th Avenue • Cicero, Illinois

What can we do

WITH

ALL THESE MACHINES?

Foreseeing Victory in the war, some of the doubters are beginning to say "Machine tools are going to be a dime a dozen. We'll have too many."

But wait.

By 1944, we shall have a dammed-up market for twice as many new automobiles as any one year has ever produced. And the whole world will be after all the surplus we can turn out.

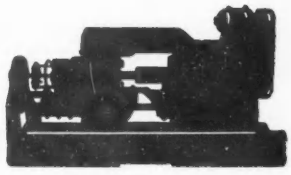
Today, less than a quarter of American farms are mechanized, and only 1% in the whole world. Few have all the tools they need. We are not now making enough implements to replace those that are wearing out.

And even our enlightened country needs millions of modern houses. We have made just a start toward real convenience, health and safety in the home.

Every day sees more of our living equipment worn out—and our post-war backlog of demand increased.

Filling this demand is the job that Acme-Gridley Bar and Chucking Automatics will do—machines that are built to produce high quality metal parts in great volume, at low cost.

Low-cost production *must* be the basis of sound and lasting prosperity. Acme-Gridleys began, 40 years ago, to prepare for that.



ACME-GRIDLEY AUTOMATICS maintain accuracy at the highest spindle speeds and fastest feeds modern cutting tools can withstand.

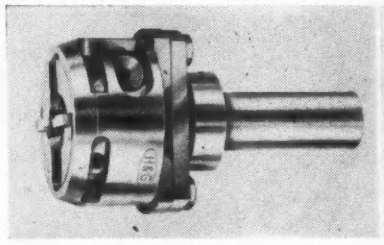
The NATIONAL ACME *Company*

CLEVELAND · OHIO

Cunningham Safety Sleeve Holder

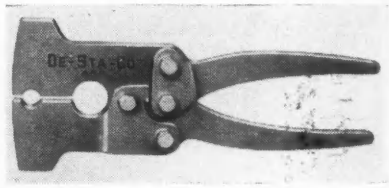
for quick change of steel type inserts, keeps the holder in place. The type holder is made of Cunningham's special "Safety" steel. The manufacturer states that this efficient marking device can be made with any size or number of characters.

THE Eastern Machine Screw Corporation, New Haven, Conn., has just brought out a line of solid adjustable insert chaser die heads, Style SAML, for use on all sizes of Brown & Sharpe automatic screw machines. These heads are complete with holders, and are provided with an alignment feature to take care of misalignment of turret and spindle. The H & G insert chasers used in these heads are made of high speed steel, and are said to be easily removable for grinding.



Style SAML Solid Adjustable Insert Chaser Die Head

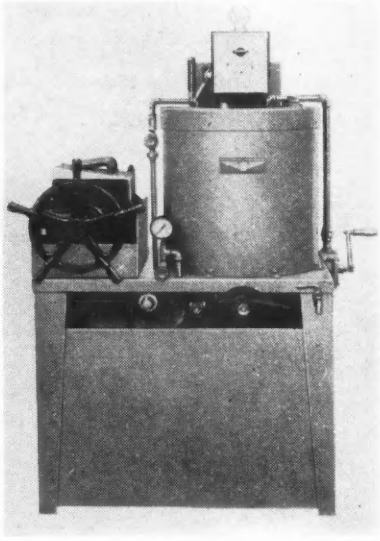
A RECENT addition to the De-Sta-Co line of the Detroit Stamping Company, Detroit, Mich., is Toggle Pliers No. 455, designed for holding piping, tubes, rods or other cylindrical parts during manufacturing operations. These pliers lock into position and hold securely at any point within their gripping range, and are easily and quickly released.



De-Sta-Co Toggle Pliers No. 455

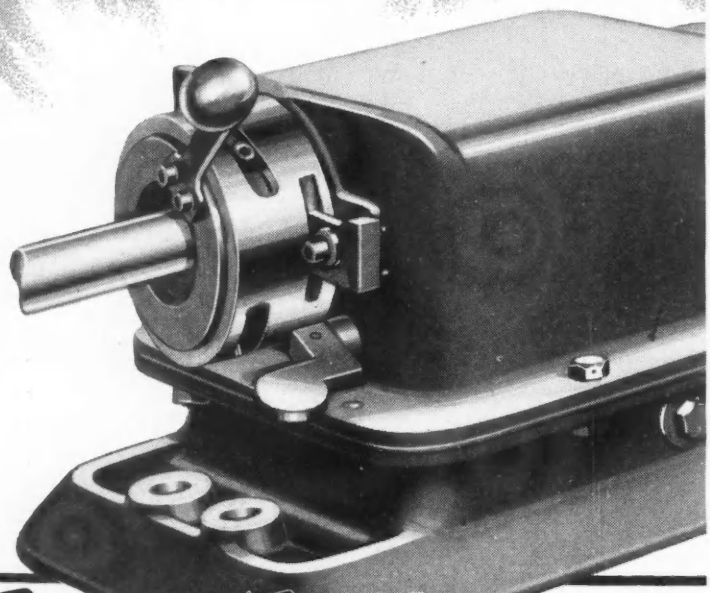
The one illustrated will hold any cylindrical object from ½ in to 1¼ in O.D. For holding other sizes these cylindrical toggle pliers are bored and slotted to order, to fit the user's requirements.

For specific information, write Detroit Stamping Co., 335 Midland Ave., Detroit, Mich.



THIS Model A-8 Oil Reclaimer, which has a capacity for purifying eight gallons of dirty oil in 70 to 90 minutes, is now being manufactured by the Youngstown Miller Company, Sandusky, Ohio. It has a two-stage filter press and utilizes common refinery earths. It is semi-automatic, operating under thermostatic control.

BEADS TUBES FIVE TIMES AS FAST



Three to Five Thousand

BEADS PER 8 HOUR DAY!

SPEED up production with a Wayne Tube Beader. Users report 3,000 to 5,000 perfect beads per day per machine with unskilled operators. It solves your beading problem completely! Releases skilled men for other work. Tell us your problem or write for folder, list of users and prices today.

NOW IN USE IN LEADING AIRCRAFT PLANTS

THE WAYNE PUMP COMPANY
FORT WAYNE • INDIANA

Wayne

TUBE BEADERS

HILLS-McCANNA

MAGNESIUM ALLOY SAND CASTINGS

. . . are in use today throughout the aircraft industry, wherever the combination of light weight with great strength is a factor. Although our complete facilities are now engaged in war production, there is certainly no better time for you to look ahead and discuss with us your projected peace-time plans and products.

FOUNDERS OF NON-FERROUS ALLOYS SINCE 1870

HILLS-McCANNA CO.
3015 N. WESTERN AVE. CHICAGO

PROPORTIONING PUMPS · AIR & WATER VALVES · CHEMICAL VALVES
MARINE VALVES · FORCE-FEED LUBRICATORS · DOWMETAL CASTINGS

Acme for Action
ARMY E NAVY
Action, trigger-quick action, sets the enemy on the run as our boys land on foreign shores.
And quick action on the home front in producing needed equipment will help keep the enemy on the run.
So here at Acme we constantly strive to break production records in supplying patterns, dies, heat-treated aluminum castings, and specialized tools needed by war plants to speed production of war materials.
Acme service is complete, including engineering counsel when desired. Submit your requirements without obligation.
ACME PATTERN & TOOL COMPANY, Inc.
DAYTON, OHIO
Heat-Treated Aluminum Castings—Patterns—Tools—Tool Designing—Production Processing
For VICTORY buy WAR BONDS and STAMPS

CENSORED

An exclusive feature prepared by M. W. Bourdon, special correspondent of Automotive and Aviation Industries in Great Britain.

The Ministry of War Transport has issued a warning to owners and drivers of vehicles running on producer gas, emphasizing the danger of carbon monoxide poisoning. It points out that the gas from a producer contains from 25 to 30 per cent of the poisonous constituent and that a concentration of 1 part per 1000 of air is sufficient to have harmful and eventually fatal effect upon a person breathing it. Beyond the ill-effects from exhaust gases when the engine is idling, a particularly dangerous condition is mentioned, i. e., when the hopper lid is removed for refuelling. It is advised that breathing-rescue apparatus be kept in every garage where more than two or three vehicles have producer plants and that the staff be trained in its use.

J. C. Haefeli, chief engineer of the engine and chassis section of the Austin Motor Co. Ltd., in an interview, has expressed as his personal opinion the view that British manufacturers of similar types of passenger cars should collaborate in post-war design with the object of securing extensive standardization of parts prone to be in greatest demand for replacements by reason of normal wear. He would leave each manufacturer free to decide his own range of models and to make his cars obviously different from those of his competitors. But he would aim, in the case of all 10 h.p. cars, for instance, at having interchangeable pistons, connecting rods, valve and valve springs, gears, rear axle shafts, hub centers and so on, thus making it comparatively easy for every stockist, at home and overseas, to carry a complete range of normal replacements for every make of 10 h.p. car. The same would apply to other popular ratings, such as the 8 h.p. and 12 h.p. models, and many of such standard parts would be built into, say, a 10 h.p. Four, a 15 h.p. Six and maybe a 20 h.p. Eight. Haefeli would also urge the Government to change the basis of tax ratings from cylinder bore and number to piston displacement.

When the invasion of Britain loomed large as a possibility in 1940, a regulation was put into effect making it compulsory for every motor vehicle left unattended in a public place to be "immobilized" by the locking of ignition and doors and in some cases by the removal of a vital part, such as the ignition distributer head. This regulation has now been annulled, except in the case of specified areas bordering on the North Sea and English Channel. The ringing of church bells, prohibited at the same time, except as an invasion warning signal, has also become permissible again, while the direction posts and plates that were removed from alongside highways are being progressively restored.

As from June 1, the Ministry of War Transport has assumed control of laminated spring supplies and replacement leaves. Deliveries by stockists and manufacturers may now be made only when and where a Certificate of Need has been obtained from the Ministry.

To encourage the successful and more extensive use of wrought light alloys, particularly after the war, a series of lectures is being given at

(*Turn to page 80, please*)

ARE YOU HOARDING IDEAS?

Are you storing away in the back of your head—in safe or desk drawer—the plan for a mechanical or electrical device that you mean to bring out *after the war*? Wars always end more abruptly than they begin. How long would it take you, if the war should end next month, next year, or even two years hence, to get that product into distribution? Bring your product to us NOW! While General Instrument is at present engaged 100% in war effort, our plants and personnel are geared for the development and volume output of precision products—all set to swing into civilian service the moment the Axis runs up the white flag.

At a time when a global struggle for freedom was not even dreamed of, General Instrument was engaged in wide-scale development of peace time products like this for peace time use.

GENERAL INSTRUMENT CORPORATION

829 NEWARK AVENUE, ELIZABETH, N.J.

Studying Oil Film

(*Continued from page 44*)

improve, and this tendency becomes more marked with an increase in the rpm. However, with a drop in the gas pressure a short-circuit condition is reached once more, so that there are altogether three short circuits near the top dead-center position.

The effect of the gas pressure decreases continuously with increase in speed, either because the pressure in the ring groove no longer attains the full value of the pressure in the cylinder, or because the oil film which has been built up by the higher speed can sustain the higher load without breaking down. At the maximum speed attained during the starting-up period, 600 rpm, a complete short-circuit or breakdown of the oil film occurred only at the moment the motion reversed, that is, in dead center. Runs without gas pressure in the cylinder showed that in that case the breakdown of the oil film near dead center extended over a much shorter period.

Among the conclusions drawn from these and other experimental studies of ring and cylinder wear is that gray cast iron of a pure pearlitic structure and medium-sized graphite veins, with no difference in hardness between ring and cylinder wall, ensures the lowest rate of wear.

CENSORED

(*Continued from page 78*)

many large engineering centers and technical colleges throughout the country on behalf of the Wrought Light Alloys Association, a body representing manufacturers. Lectures are illustrated by specially prepared films and deal with the various types of heat-treated and non-heat-treated alloys and their working to the form required by hot forging, cold forming on mechanical or hydraulic presses, extrusion, stretching, machining and welding.

The net profit of the Dunlop Rubber Co., recently announced, was down from £3,186,269 in 1941 to £2,433,307 in 1942. After making allowances for taxation and tax reserve (£1,787,955) and contingency reserve (£100,000) and the payment of dividends on the preferred shares and ordinary stock (8 per cent, less tax, on the latter) the balance carried forward is shown at £627,586, practically the same as the amount brought in from 1941.

A proposal under discussion is a British University of Aeronautics, and a good case is made for the immediate establishment and Government endowment of such an institution for the advanced training of aircraft technicians. The object would be to bring under one roof all the sciences and branches of engineering and technology directly and indirectly connected with aircraft problems. Backing the proposal, one well-known aircraft manufacturer has outlined a five-point program.

The British Standards Institution has issued a War Emergency Specification relating to the dimensions of drilling-jig bushes. It covers press-fit bushes, renewable bushes and liners for renewable bushes for drill sizes up to 1¼ in. and is primarily concerned with such dimensions of bushes and liners as are necessary to secure interchangeability and satisfactory performance; for this purpose complete tolerances are specified. The number of normal sizes has been reduced to the minimum and for each size there are two or three alternative lengths in place of the large number hitherto customary.

On behalf of the Ministry of War Transport it has been stated in Parliament that plans are far advanced for the building of special motor roads after the war. The program will include new motorways in open country, improvement of existing highways, segregated ring roads in and about cities and large towns and radial arteries on which only fast-moving motor traffic will be allowed.

London's Future Airports

In the "master plan" for the rebuilding of London, conceived and published by the London Regional Reconstruction Committee, air transport is given a prominent place. A site for an "inner" airport has been selected to the north of the Thames, about three miles from the center of the city and not far from a new basin for the Port of London supplementing the existing series of docks. Proposed termini for heavy long-distance air traffic consists of "external" airports, two pre-war sites, about 10 miles from the west end of London, being proposed.

With that curtly classic reminder, one of America's most famous research engineers replied to a man in the act of rhapsodizing about the wonderful ingenuity of man.

For the barnacle, he pointed out, is a symbol of all those things that have *not* been done—a tiny marine organism that costs us millions every year—simple, "impossible" things that are still to be accomplished.

The development of lighter and stronger alloys, permitting 3, 5, or even 10 horsepower for every pound of engine weight, instead of one-to-one . . . cheaper color photographs and faster engravings and better television . . . swifter ways of making and working new super-hard alloys . . . scores of different kinds of rubber "growing" on factory floors, and fuels 3 or 4 times as powerful as 100-octane gasoline . . . even solar energy, and atomic power, and—remember the barnacle! These are but a few from a list of certainties and possibilities as long as man's imagination.

Under the secrecy of forced-draught war research, many incredible accomplishments—seemingly impossible within our time—have already occurred. For obvious reasons, these may not be discussed, but of one thing we can be certain: The end of this war will inaugurate the greatest era of industrial surprises since the age of machinery began.

And the shift to light metals and plastics may be as consequential as the shift from bronze to iron!

We at Bryant have developed many new techniques during the past few months. Our engineers are working on hundreds of production lines today, helping to solve production problems involving the machining of hard rubber, plastics, glass, graphite, cast iron and bronze, as well as forged, centrifugally cast and surface-hardened steels, light metals and alloys from a hundred new specifications.

If this wealth of new experience can be of value to your business, it's there for the asking. For Bryant's Consulting Service on internal grinding is available to you at all times.

Call upon us now!

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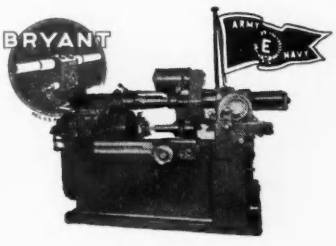

SEND FOR THE MAN FROM BRYANT

Tailoring American Planes

(*Continued from page* 20)

and line arrangement probably will have to remain highly fluid.

Quite a number of other aircraft manufacturers besides Consolidated are operating Modification Centers, including Bell, North American Aviation, Glenn L. Martin, and Douglas. Transcontinental and Western Air, Inc., operate a Center at Kansas City and the United Air Lines operates one at Cheyenne, Wyo., under the supervision of the U. S. Army Air Forces Materiel Command's Production Division. It takes production airplanes and fits them for either Arctic or desert operation, increases their range, or increases their bomb-load capacity as called for by new conditions. The personnel is recruited largely from civilians, the proportion of women employed being about the same as in aircraft factories.

Lockheed Aircraft Corp. operates what is said to be the biggest Modification Center in the United States and the first to get into operation—in Dallas, Texas. This Center is located at Love Field and comprises four huge hangers, an extensive shop area, and recently-completed buildings for flight operations, warehousing, and offices. The Center is the newest unit in the worldwide network of training, supply and maintenance services that Lockheed and Vega have established for the air forces of the United Nations. These services, under the general direction of Carl B. Squier, vice-president of the Lockheed and Vega companies, include extensive operations abroad and keep a large corps of aircraft experts constantly on the go. Sixty per cent of the personnel at the Dallas Center were hired locally and rapidly trained as aircraft operatives under a program directed by Ellis Wright, the Lockheed-Vega training coordinator. Sixty per cent of the so-called "new hires" today are women.

At Dallas Lockheed P-38 "Lightning" Interceptors are "winterized" or "summerized" for Arctic or tropic regions by special treatment of oil and fuel lines and of carburetor equipment. New navigation instruments are installed as they are developed or required. Scores of the British version of the P-38 are being Americanized.

Vega Ventura bombers, which only recently have emerged from close secrecy and have been adopted by the American as well as the British air forces, are being fitted for several missions suggested by their great power and range. Some will operate on offshore patrol against the submarine menace. Others will tow the gliders which are being developed by the Army Air Forces, when the intricate towing mechanism has been installed or will tow targets for ground or aerial gunnery practice. Others still are being converted into training ships for bombardiers and aerial gunners.

Lockheed Hudson bombers, which have been used by the British for several years, also are being "modified" at Dallas. On many Hudsons American guns are replacing British armaments, new standard instruments are being installed, and general modernization of older models diverted from delivery to the British is under way. Many of the fighting ships are recamouflaged at Dallas, when an emergency change of orders sends them to a desert instead of to a jungle region, or to over-water operation instead of to shore duty.

The history of the Dallas Center furnishes an example of the speed with which these centers are being placed in operation. Authorization to establish the Center was received on Feb. 18 of last year and on Feb. 23 the Center was operating—with men and material flown to Dallas from Burbank. The men naturally were veterans from the Lockheed and Vega plants who knew the ships thoroughly. Two hangers were leased at Love Field, and U. S. Engineers at once began construction of the big "permanent" structure. Late in July the Modification Center moved into the first bay of this structure. Meanwhile as many as 40 classrooms in Dallas schools had been busy with the job of training local labor in modification operations.

Characteristic of the design of all STURDIMATIC LIVE CENTERS is a low overhang and a slight cushioning action . . .
that compensates for expansion due to heat, shock and excessive thrust loads—reducing wear to a minimum. A properly engineered live center is one of the fundamentals of setting up a job and requires a specialist's experience . . . standard shanks with Morse taper carried in stock.

Send us your specifications and blueprints—We will see that your job is set up with the right LIVE CENTER—prompt deliveries on high priorities.

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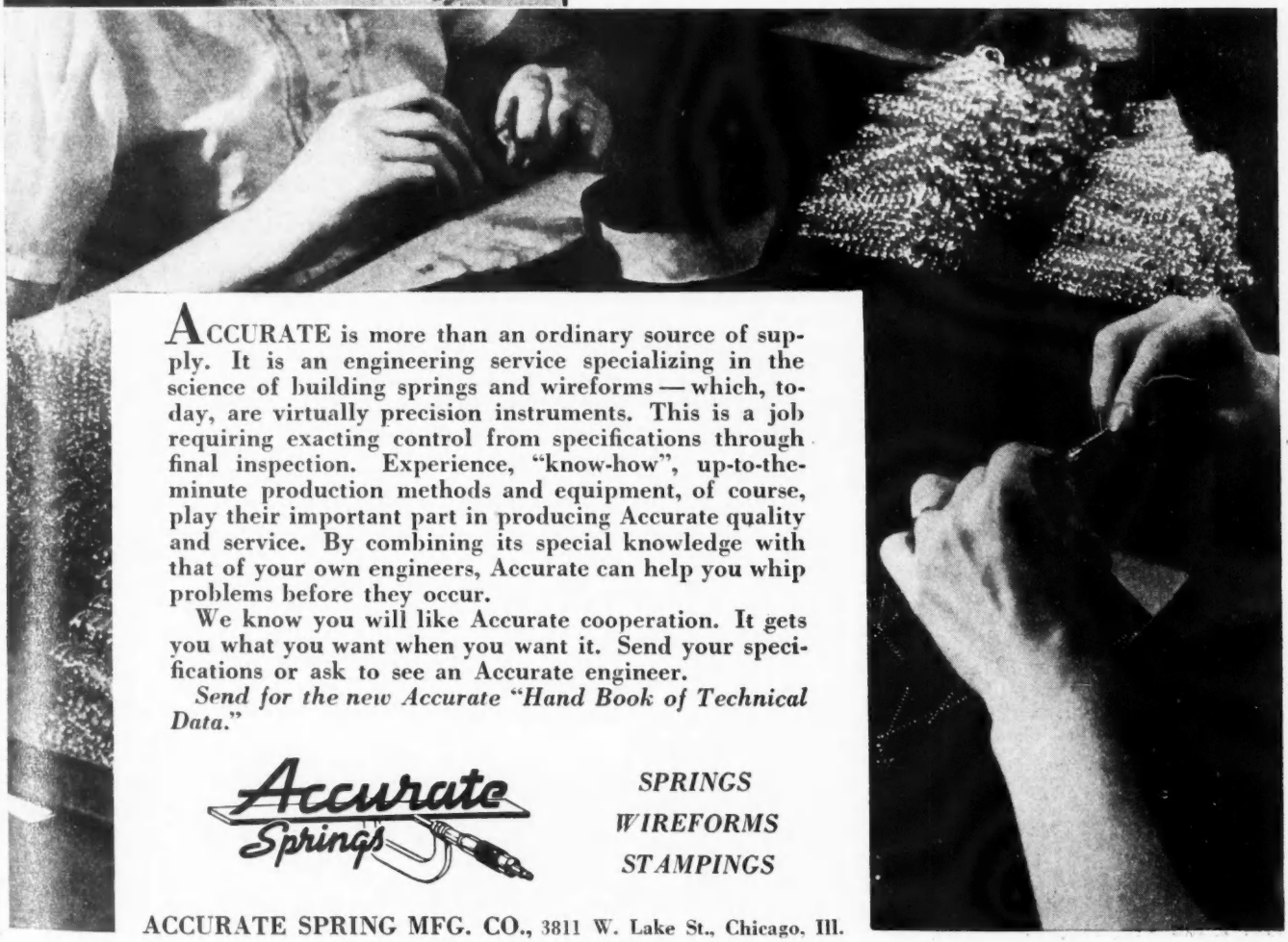

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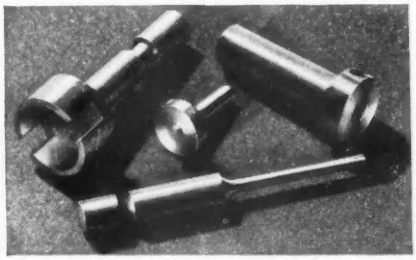
PRECISION PARTS

THEIR END-USE IS A SECRET

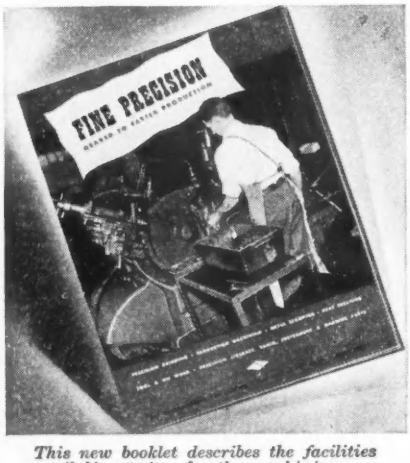
A story of amazing accuracy of American instruments will come out of this war. It can't be told yet because there are still a lot of surprises in store for Herr Hitler and his gang of bandits. There is no secret, though, back of the amazing precision work that has made this accuracy possible.



". . . ten times as fast . . ."

These small, army, instrument parts are typical. Each is centerless ground to within tolerances of .0002". Concentricity between diameters is held to limits of ten thousandths. Some of them call for definite radius requirements where the shank meets the head. Others must have no radius at all. And there is another very important requirement—they must be turned out by the thousands.

Ace is a pioneer in this ever-increasing accuracy which World War II has taught to mass production. Management "know-how" and modern equipment are turning out tolerances as close as .0001", and finishes which a speck of dust or a warm hand distorts—and doing it ten times as fast as ever before. Ace is a dependable source for volume production of Bar Stock, Shafts, Studs, Pins, Punches, Taper Pins and parts. Diameters may be as small as .020" or as large as 6". Capacity is available for your Centerless Grinding requirements. If you have any grinding problems send us a sample, sketch, or blueprint for quotation.



This new booklet describes the facilities available at Ace for the machining, assembling and heat treating of small parts. A copy will be gladly sent upon request.

ACE MANUFACTURING CORPORATION

for Precision Parts

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Qualifications of a Safety Administrator

(*Continued from page* 60)

suggested answer and then, failing to get action at once, shrug his shoulders and say, "O.K. It's up to him now. I told him what to do. If he doesn't do it, it won't be my fault." Everyone can see through that excuse. It merely means that you are a poor salesman, that you presented your case poorly, that you didn't follow through. You may think that you are making yourself look good when you agree with a workman or a foreman that a safety job should be done and then tell him that you've suggested it to the boss but he won't listen to you. You aren't, though. You're merely showing him that there's no reason to come to you with an idea. You've already said that you can't get the boss to listen to you.

So our ideal safety man will have to be a salesman, one good enough to make the boss spend his money and the workman spend his thoughts and efforts on how to work safely.

Another essential trait of character that he must have is willingness to take responsibility. Industrial safety work is still too new to be well understood by operating executives, and usually they hesitate to charge the safety engineer with responsibility for the plant's injury record in the same manner that they charge the production superintendent or the sales manager for responsibility for their records. Executives are still somewhat prone to believe that "accidents will happen," and our ideal safety man should have so lively a sense of responsibility that he can sell the boss on the idea that they don't just happen.

What sort of an education should our safety man have? If he has the traits of character mentioned earlier he will have gained an education, in school or out. I'd like him to know the scientific method of approach to any problem. I'd like him to be able to do a good job of getting the facts, analyzing them, drawing logical conclusions from them and constructing a plan of action to fit them. If he can get that sort of training in an engineering school—splendid, we'll have him get a degree in engineering. If he can get it in commerce and finance courses—swell; we'll have him take them. If a study of philosophy will do it, I'm for that. If a night school course in blueprint reading will do it, that still suits me. The only essential in his education is a knowledge of the scientific method.

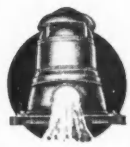
Experience

Experience as well as training should be looked at when we hire this ideal safety man. Where has he been, what has he seen, who has he known?

I'd like him to have had experience in the type of business he is to do his safety job in and I'd like that experience to have been on several different levels. If he is going to do safety work

(*Turn to page* 146, please)

THE OLD WINDJAMMERS



The old "windjammers" were built to sail the heaviest seas that rolled. In fair weather or foul, with rare exceptions, they delivered their cargoes. It was sturdiness in build, skill in design and quality of materials that made them give such good service.

It is in a like manner that Layne Pumps and Well Water Systems are constructed:—sturdy, efficient—long lasting—and above all, reliable. Some have been in service for a quarter century. Later installations were designed and built to last even longer.

Such outstanding quality will make Layne Pumps and Well Water Systems first in choice for the post-war era. They will be chosen wherever large quantities of water must be produced at exceptionally low cost. Layne Pumps and Well Water Systems have been proven the world over—proven for basically sound quality, advanced engineering features, sturdiness in construction, unequaled efficiency and outstanding reliability.

For the duration the Layne Organization is, in addition to doing much urgent war work, endeavoring to keep present installations in repair and operating at top efficiency. If you wish literature, address, Layne & Bowler, Inc., General Offices, Memphis 8, Tennessee.

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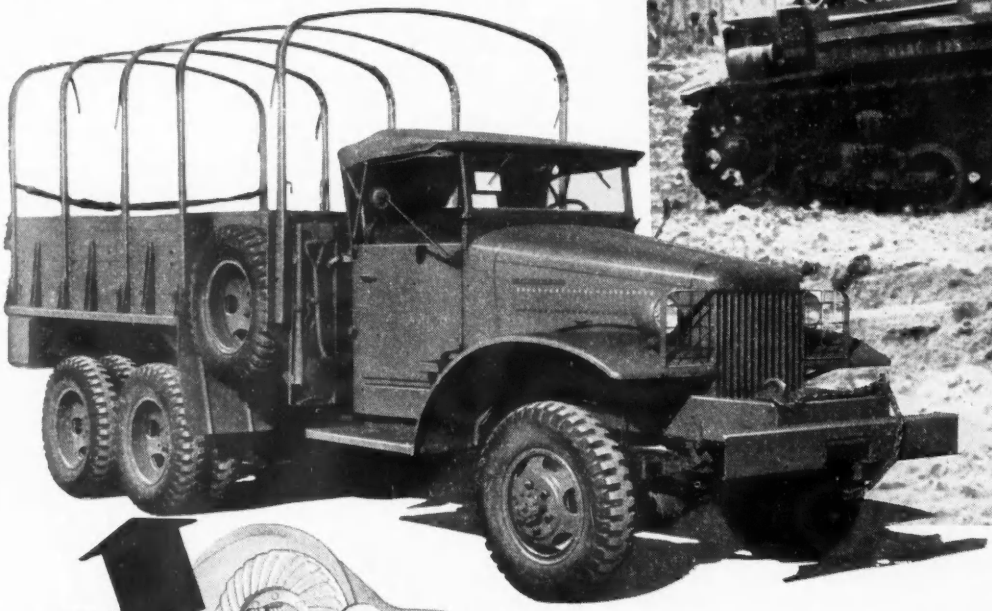
Just a foothold—that's all they ask. Tropic mud or arctic snow—they are all the same to the Marines.

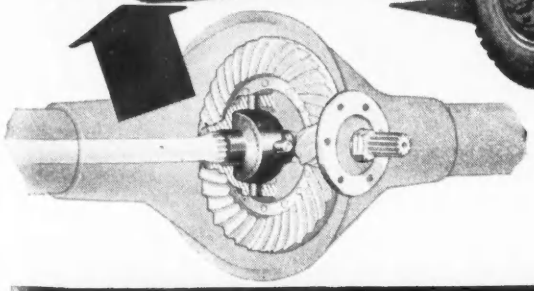
Like the Marines, the motorized equipment used by them usually has a strictly "off-the-highway" job. A typical unit is this rugged, 2½-ton truck, fittingly named the "Marine 6 by 6." It is noteworthy for its lower silhouette, its husky power plant and, above all, for its tremendous tractive ability.

THORNTON *Automatic-Locking* DIFFERENTIAL

in both rear driving axles eliminates wheel-spin and gives positive traction in mud, sand, snow or ice.

These THORNTON qualities that serve the Marines so well . . . sturdiness, tractive ability, dependability . . . fit equally well into other military vehicles.





The THORNTON Automatic-Locking DIFFERENTIAL provides full driving torque to either wheel, even though one wheel is on ice, snow or mud.

Thus there is no wheel-spin . . . instead there's positive traction even under conditions where trucks with ordinary differentials would be stuck.

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Manufacturers also of the THORNTON Four-rear-wheel DRIVE for trucks

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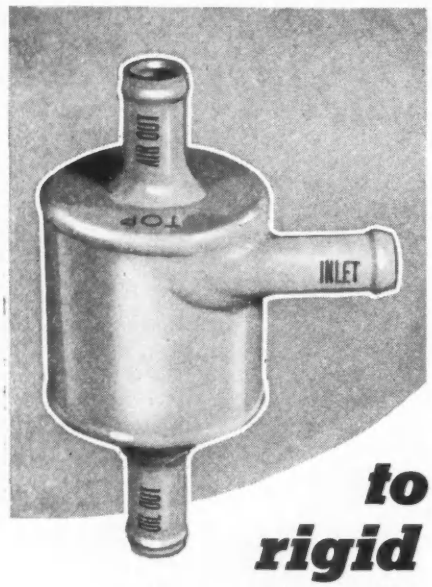

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take oil separators for the vacuum pump in de-icing equipment. For years, we have supplied these small but vital parts to Army and Navy. Today, most builders of military airplanes in this country and in Canada call on us for these essential devices.

At the Cradle of Aviation

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in the corn starch business, for example, I'd like him to have had jobs in the mill house, the packing house, the maintenance shops, the laboratory and the office before he starts on the safety job. He should have, at any rate, done some sort of work with his hands and some sort with his head. He should be able to talk to the janitor and the president and he should be able to appreciate both points of view.

That, as I said, would be ideal. Less than ideal, but adequate, is almost any experience at all in dealing with people and machines, the two X's in the safety equation.

So far we have talked about ideals but made some compromise with reality. Let's forget reality entirely now for a moment and look at the knowledge a safety man should have to do his job ideally well.

First, he should be a combination chemist, mechanical, electrical, sanitary, civil and structural engineer, because he'll run into problems involving all of those professions when he tries to produce a work environment free of all mechanical hazards. Second, he should be an advertising manager, an editorial writer, a competent psychologist and a good public speaker so that he may do a sound job of educating workers to avoid the hazards not yet susceptible to engineering.

Third, he should be a doctor so that he can have some knowledge of the healing arts and the rehabilitation necessary for those who fall victim to his having done a less than perfect job of accident prevention and a lawyer so that he may know the rights and duties of the employee and his employer.

If that isn't enough—he should also be a time study engineer because the speed and effort with which men work have a definite bearing on their safety. If they work too hard and fast they are tense and nervous: if too slow they wool-gather. The safety man should also be a purchasing agent because he is buying a specialized type of equipment but I am inclined to think that, if he masters all of the professions just mentioned, he'll automatically do a good job of purchasing.

Collaboration

Practically it just isn't possible for any one man to have an expert knowledge of all those fields. But we *can* gain a rudimentary knowledge of all of those things from reading and study and, for detailed expert information, we can develop pipe lines, pipe lines of information. Practically all of us work for firms that have experts in all of those fields and it's our job to get and stay on such terms with those experts that we can call on them for help when our problems need specialized treatment. That's what every operating executive does, for they face the same problem we do. They can't know every detail of their business, so they hire dependable experts to know them. The ideal safety man will enlist the help of all of those experts in doing his job. Without them he is lost. With them, every technical problem can be solved.

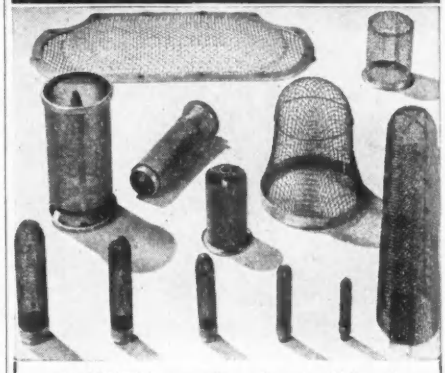
Those pipelines I mentioned can be used for pumping out as well as for siphoning in. The chemist who helps you lick a chemical problem can be sold enough of the safety attitude to cause him to check on the toxicity of a chemical he is about to introduce into the plant process. The civil engineer who helps you on a drainage problem can be sold enough safety that he'll leave proper clearance on the next track he lays out and will remember to think about the truck drivers' line of vision when he puts in the crossing. The plant publication editor who helps on a safety story can be sold the necessity for remembering safety in every story he writes.

There is one more point. You can't be everywhere all of the time and you can't know everything that is going on. So, unless you make yourself some volunteer helpers who have been sold on their responsibility for safety, the job will be done only when you are there to do it. And that won't be in enough places or at enough times.

Nose Turret Removed

A revised version of the British Halifax bomber has had the nose turret removed to save weight and increase its speed. A survey showed that the nose guns are used rarely.

STRAINERS for the AIRCRAFT INDUSTRY



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